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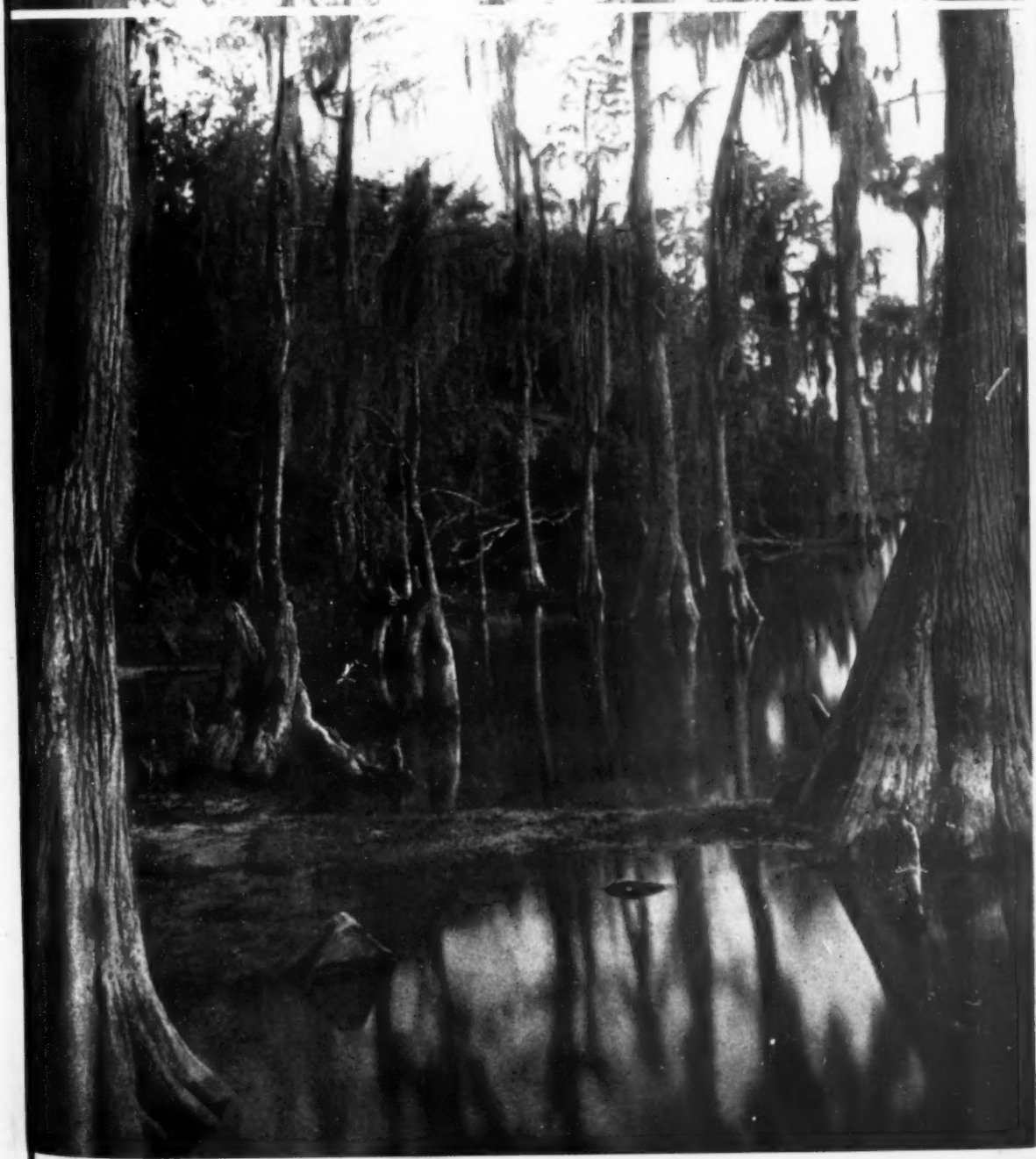
THE AMERICAN MUSEUM JOURNAL



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CONTENTS FOR APRIL

A Typical Coral Reef of the Bahamas 216

Reproduction from photograph of coral reef group in the Brooklyn Museum

Color Plate, The Flamingo and its Young ..... opposite 217

Photographic study, made in the Bahamas, for the flamingo group in the American Museum of Natural History
This color plate is the frontispiece in a new edition of the Museum's guide leaflet on the bird habitat groups

My Fight with the Devilfish ..... Russell J. Coles 217

Story of methods used and dangers encountered in securing for the American Museum of Natural History a specimen of the great fish, *Manta birostris*
Illustrations from photographs by the Author

Heredity and Sex ..... Frank E. Lutz 228

An exposition of the Mendelian theory of inheritance and some of its recent developments
Illustrations from photographs of exhibits in the American Museum of Natural History

Color Plate, Assyrian and Babylonian Seals ..... opposite 243

Specimens from the Morgan-Tiffany collection in the American Museum. Color plate issued in a recent book, *The Magic of Jewels and Charms*, by George Frederick Kunz

"The Magic of Jewels and Charms" ..... Herbert J. Spinden 243

Review of a recent book by George Frederick Kunz, honorary curator of gems in the American Museum, on legend and lore of precious and other stones

The White Rat and Sleeping Sickness ..... R. W. Tower and C. F. Herm 249

Observations, made in the physiological laboratory of the American Museum, on the blood parasite of sleeping sickness

A Reptilian Aëronaut ..... W. D. Matthew 251

On the structure and probable habits of an ancient flying reptile

The Traffic in Feathers ..... T. Gilbert Pearson 253

Account of methods of the feather trade in meeting the demands of fashion and their effects on the bird life of the country

Stories of South American Birds ..... George K. Cherrie 259

Personal experiences with reference to the nesting habits of flycatchers, spinetails, jacamars, orioles, and puff birds
Illustrations from photographs by the Author

Museum Notes 265

Mary Cynthia Dickerson, *Editor*

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The Journal is sent free to all members of the American Museum.

By courtesy of the Brooklyn Museum Quarterly

A TYPICAL CORAL REEF OF THE BAHAMAS

[Series of Recent Museum Groups]

The model for this group in the Brooklyn Museum was an actual coral reef near Nassau in the Bahamas. The group gives an idea of the abundance, variety, and beauty of the undersea animal life. Observations were made by use of a water glass, and of the specially constructed photographic chamber used by the Williamson Expedition for their motion pictures "Thirty Leagues under the Sea." By means of this chamber it is possible to observe the submarine life for hours at a time through a lens five feet in diameter.

Expedition for their motion pictures. Thirty leagues under the sea. By means of this [illegible]
a lens five feet in diameter.

Courtesy of the Century Company

THE FLAMINGO AND ITS YOUNG

One of many photographic studies made in the Bahamas by Dr. Frank M. Chapman, in preparation for the construction of the flamingo group in the American Museum of Natural History. [This color plate is the frontispiece in a new edition of the Museum's guide leaflet on the bird habitat groups.]

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My Fight with the Devilfish

By RUSSELL J. COLES

FOREWORD: The devilfish, *Manta birostris*, is the largest of all the rays and one of the largest creatures of the sea. There are fabulous stories of its tremendous strength and great size, but it probably does not exceed a width of about twenty-five feet. It belongs to a peculiar family of rays distinguished by the fact that they have a pair of flaps or feelers, one at either side of the mouth, which help in their feeding. These feelers can be curled up tightly to resemble a pair of horns and it is probably to this fact that the fish owes its common name. The American species of devilfish, *Manta birostris*, occurs along the coasts of Brazil, the West Indies, and the Gulf of Mexico. Occasionally a specimen may stray as far north as New Jersey. It occurs also on the Pacific side of Mexico, ranging south to South America. Specimens however, are so rare that it is not absolutely certain whether the Pacific devilfish is of the same species as the Atlantic one. Mr. Russell J. Coles has fished for many years in the lakes and rivers and along the coast of Canada, as well as along the Atlantic and Gulf coasts, and has made many valuable contributions to the collections of the American Museum's department of fishes. The expedition described below was equipped and financed entirely by him and the monster devilfish he afterward presented to the American Museum is now being modeled and will shortly be placed on exhibition.

WHEN I first undertook to obtain a specimen of the great devilfish (*Manta birostris*) for the American Museum, I was already familiar with the literature on this great fish, and I realized that the general methods of procedure, which had resulted in failure for other expeditions in search of it, must be improved upon. Accordingly I spent some time in a careful study of the problem before setting out on an expedition, concentrating attention chiefly upon the sharks and rays. I found that both sharks and rays sometimes continue fighting long after both brain and heart have been pierced by lance and bullet, but that death is instantaneous when the spinal cord is severed at a certain spot just back of the brain. I had usually been able to accomplish this on the sharks and rays which I had previously killed, by means of a sharply ground whale lance, but I knew that a much more effective weapon would be required to achieve the same effect on the great devilfish, and I therefore designed and had forged a huge lance, more than three times as heavy as a whale lance, which I call a "spade lance" on account of its having a square cutting edge four inches wide.

Now the *Manta* has been known to tow a hundred-ton vessel far out to sea, and on another occasion eight boats lashed together, and in both these cases the crew was obliged to cut the rope and let the animal escape. The wonderful vitality of this creature is well known and there are many authentic records of its having escaped capture after being harpooned, lanced, and shot many times with rifles of heavy calibre.

With these facts before me it became necessary to devise means to bring the

devilfish to close quarters as soon after harpooning it as possible, and to this end I designed a drogue [1] of the same shape as that used by whalers, only it had to be large enough to stop the first rush of the harpooned fish. Knowing that there were certain parts of the body where the flesh was so filled with connective tissue that a harpoon could not draw out, I made my harpoon line only forty feet long and attached to it a drogue more than three times as large as the largest I have known to be used on whales. I also carried a very powerful repeating rifle and a large shoulder whale gun, from which either a harpoon, or a bomb lance containing half a pound of powder, can be fired; but many years of handling harpoon and hand lance have given me confidence in these and I have never used either rifle or whale gun in killing devilfish. Several extra harpoons and whale lances, and two extra drogues were carried; but I did not expect ever to have occasion to strike more than one blow with the spade lance, so I carried only one of these. To guard still further against any possible miscalculation I took on both my *Manta* expeditions the man who had been my captain for ten years, Charlie Willis, of Morehead City, North Carolina. The plan is that the instant that I throw the harpoon with drogue attached, he shall throw another harpoon with half a mile of rope attached. The second harpoon however, has never proved necessary, as the drogue has always stopped the rush of the fish.

Following these preliminaries, my first expedition for *Manta*, in the summer of 1914, was successful in that it secured the only two specimens of *Manta* that were located; but neither of these was as large a specimen as I wished to obtain, and as both were males the scientific data they yielded was incomplete. I determined to return to the southwest coast of Florida and secure a female *Manta*, fifteen or more feet wide, for the American Museum of Natural History.

My second expedition was equipped more completely than the first. On my arrival on the Florida coast, however, on March 28, 1915, I encountered very unfavorable weather, and it was not until April 6 that I saw and killed a *Manta* in a hot eight-minute fight near Blind Pass. Upon towing it to the beach I found it to be a male about thirteen feet in diameter, and after securing parts of the fish I left it. We had only run a short distance after this before I saw a dark coloration on the water caused by a *Manta* coming toward the boat. It was fully fifteen feet below the surface, but the two harpoons reached it and the great ray came to the surface with a rush that broke both harpoon handles short off against the bottom of the boat. The boat was knocked clear of the water, but as it was falling back, I placed the spade lance just at the back of the brain, and with a last harsh bellow the fish died, within a few seconds after the harpoon first struck it. This fish, however, also proved to be a male, and it was not until April 11 that I got the female devilfish over eighteen feet wide that I had long been planning for.

The killing of my first four *Manta* was attended with much sport, some danger, and lots of blood, but every detail worked

[1] A drogue is a device for offering the greatest possible resistance to a pull. That used by Mr. Coles consists of two pieces of plank, eighteen inches long and nine inches wide, placed side by side and nailed firmly to two similar pieces placed beneath them with the joint running at right angles to that in the two above. A hole about three inches square is cut in the middle of the planks and a heavy piece of timber fits into it exactly on one side, being joined on the other side to a thicker piece of timber which forms a shoulder against the boards. A rope with heavy knot at the end is passed through both pieces of timber, the knot holding the rope at the end of the thicker timber, the other end of the rope being attached to the harpoon; the great resistance of this drogue as it is dragged through the water, wrenches the harpoon so severely when the fish rushes that the animal is brought up short.

out exactly according to carefully laid plans, and a detailed description would be like working out a problem in mathematics after the answer is known.

In spite of this I do not advise any one to try my method, as it is certainly dangerous. The big drogue especially makes it so, for it keeps the wounded *Manta* close to the boat, and the great weight of an adult devilfish makes the wrecking of the boat a certainty if the fish should run into it at full speed. If the boatmen attempt to keep out of the way of the wounded fish, the boat is almost certain to be sunk by a blow from one of the huge pectoral fins; while to have a boat large enough to withstand such blows would make it almost impossible to approach close enough to harpoon the wounded fish.

Placing the big spade lance in exactly the vital spot at exactly the proper instant, of course ends the fight at once; but the difficulty is to place it there and to get a crew with sufficient confidence in the harpooner to meet the on-rushing *Manta* with the boat. In spite of all my preparations the battle with the great female devilfish came near to being my last.

After several days of windy weather, which had made successful *Manta* hunting impossible, the morning of April 11, 1915, opened calm and hot and, although little was said, it was evident as we left camp after an early breakfast, that the feeling had spread among the crew that before our return we should have a great fight and get the big fish that we had come for.

To kill a *Manta*, perfect handling of the boat is necessary and a proper crew is the first consideration in equipping an expedition. In my twenty years' experience in fishing off the coast of North Carolina, I have always made up my crew from the native market fishermen, in preference to the guides and boatmen usually employed by sportsmen. On this occasion, in addition to Captain Charlie Willis, I was fortunate in securing the services of Captain Jack McCann, of Punta Gorda, Florida, beyond question the best-known and most efficient fisherman on the Florida coast, and he selected the three other members of the crew — all young men, trained, active, and without fear. Captain McCann also furnished the boat, which was a small, twenty-six-foot, open boat with an eight-horse-power gasoline engine. The construction, however, of this little boat was extra strong, or it would have been wrecked by the terrific pounding it received.

The men were nearly perfect for the positions which they were to fill, knowing what to do no matter what condition might arise; therefore not much time was required in training the crew. On such an expedition it is necessary for every man to move instantly when the word is given, like part of a perfect machine, for I cannot turn my head when the fight is on.

Charlie Willis stands forward with me to throw the auxiliary harpoon; Captain Jack McCann steers the boat; another man stands just behind me to throw the drogue overboard as the harpoon leaves my hand, and to give me my spade lance; the next man runs the gasoline engine, while the last stands ready with a bucket to bale water should this become necessary. All, including myself, are ready at a word to throw their weight on the high side of the boat if it should begin to turn over.

When the boat passed out through Captive Inlet into the Gulf of Mexico, the water was so thick that a *Manta* would have had to rise to the surface to be seen, and I posted three men to keep close watch, one on each side of

the boat, and one behind us, while I watched in front.

We had run down the full length of the coast of Captive Island and were about a mile off the shore of Sanibel Island and in front of Blind Pass, when there came, suddenly and without warning, a most terrific shock, which threw the four of us who were standing to our hands and knees for a fraction of a second. The boat, which was running at full speed, had met the head of a *Manta*, rising to the surface and coming toward us at moderate speed. The shock of the collision was so great that it almost stopped the headway of the boat, and its bow was lifted more than a foot out of the water; but our speed carried the boat up over the high part of the back of the *Manta* just as the two great black fins were flung madly into the air, almost meeting over our heads and deluging us with many gallons of water. Then the two fins crashed down on the surface of the sea with a noise that could have been heard for miles, and the *Manta* instantly repeated the performance as I yelled to the engineer, "Keep her going." Just as the boat was sliding from the back of the creature, another huge *Manta* rushed up from below, striking full on our port bow with sufficient force to spin the boat around until its direction was almost reversed. At one time all four of the great black pectoral fins were towering above us, and large quantities of water were flung into the boat. First the head and then the stern of the boat was highest as it was pitched from side to side, and then I heard the chug, chug, chug of the racing propeller blades as they gashed the tip of the pectoral fin of the first *Manta*. The engineer kept the engine going at full speed, but the propeller blades were not catching the water now, and for a short distance we were carried upon the broad backs of the two monster devils of the sea.

I fully realized the danger, as did every one of the men with me in that little boat, but every man filled his place perfectly and there was no outward show either of fear or excitement, for I had a crew composed of men who show at their best only in time of danger. Scarcely a word was spoken until, in the midst of a wild upheaval of the two madly frightened *Manta* beneath us, the boat was flung from their backs and was turning over, when I shouted, "High side!" which order was instantly obeyed, two of the men, except for an arm and a leg, throwing themselves entirely out of the boat.

The boat struck head first and shipped a lot of water over her bow, but we were now clear of the two *Manta*, who raced together on the surface for a short distance.

Almost in an instant the boat was cleared of surplus water, harpoons and ropes were rearranged, and we were in pursuit of the two *Manta*, when suddenly they went below. On looking around I saw three specimens some distance away, but all of them under thirteen feet in width; then the first two came in sight again, and after that we saw them many times, for they were easily recognized, being always together. The first showed the bleeding fin tip which had been cut by our propeller, and its mate had lost about eight inches from the tip of one of its fins in some former encounter.

These two *Manta* appeared to have lost all fear of the boat and its occupants; we were many times in touching distance of them and they both passed under the boat several times. The first was a female, well above fifteen feet in width, and I was about to attack it, when I saw, nearly a mile away, the largest *Manta* that I have ever seen. It was on the surface so I ran the boat down to it, and never have I wanted to kill any one thing

quite as badly as I wanted to kill that great fish, for it was fully twenty-four feet in width and must have weighed not less than twelve thousand pounds. I was uncertain however, as to its gender, and a female was absolutely necessary, also I had only fifteen hundred pounds of plaster of Paris — not enough to cast such a huge beast; but the principal drawback was that we could not tow such a monster with the little launch and there was no other boat in sight.

For more than two hours I moved among those six *Manta*, making observations[1] and hoping that some other boat would appear, to help me tow the carcass of the big one, but none came and finally I decided to kill the first that we ran into.

She was now swimming on or near the surface with mate following, almost touching her all the time, and, with all ready, we moved to the attack. As she was passing, quartering across our bow, I gave the word. Charlie and I drove our harpoons deep into her broad back; then, with a great splash of her fins, she plunged below and ahead. As the drogue was snatched under, it threw water high in the air and the shock was so great that it brought the great ray to the surface in that awkward, wheeling, edgewise leap that *Manta* make, after the manner of a wheel turning over. Before its tail had reached the perpendicular, I and all of my crew saw an embryo, folded in cylindrical form, thrown high in the air, and I heard Captain Jack exclaim, "Did you see that? The young one has a tail longer than the old one!" The embryo quickly unfolded its fins and, catching the air horizontally, its descent was retarded until after the mother fish had disappeared beneath the surface.

When I had hurled my harpoon and reached behind me, the spade lance had been instantly placed in my hand, but as I saw this embryo feebly flapping on the surface, I passed back the spade lance and yelled "Give me an iron, quick!" (the harpoon is always called an iron) and while not five seconds were taken in the exchange, that was too long, for as I threw back my hand to strike, the male swept the embryo beneath the surface with one of its fins.

I passed back the harpoon and seized the spade lance, as I saw the wounded female, now on the surface, charging down on us at highest speed. I was forced to strike instantly and there was not sufficient time to clear up the line attached to the lance handle, so the point of the spade lance was slightly deflected, with the result that the fatal spot was missed by a few inches. However, the force of the blow, which was delivered with both hands without releasing the handle, was so great, that it depressed the creature's head, and the head-on collision did not crash in the side of the boat as it probably would have done otherwise. The top of the head struck the bottom of the boat, breaking the lance handle short off against the side, and I was confronted with a very serious defect in my equipment. I had acquired, by years of work with the lance, such confidence in my ability to place it where I desired that I had not thought it necessary to provide more than one spade lance; but now my fish was very much alive and fighting mad and I was without a spade lance.

With this gone the danger was much increased, as the fight had to be carried on with the old-fashioned whale lance, which I had had made with the shank only three feet long instead of five or six

[1] Mr. Coles' observations on the life history and habits of the great devilfish (*Manta birostris*) together with some comparisons with its lesser relative (*Mobula olfersi*) are about to be published in the American Museum Bulletin, together with a more technical paper on the same subject by Dr. L. Hussakof of the Museum.

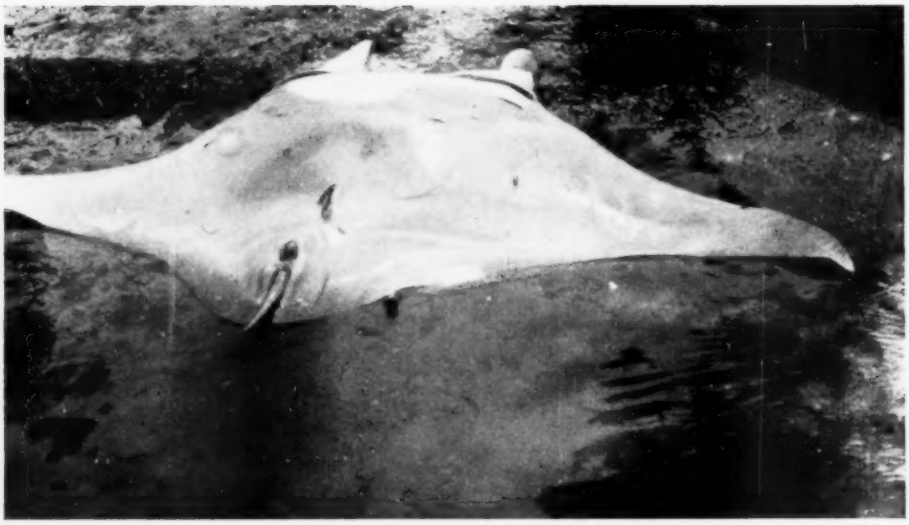
GIANT DEVILFISH ON CAPTIVE ISLAND, SOUTHWEST COAST OF FLORIDA

After the long fight it took ten hours to tow the big fish to shore. The "horns," on each side of the huge mouth, are here rolled up (compare cut opposite page). The instinct of the animal is to clasp these horns around any object that bars its progress; in this way the anchor line of a ship has many times been pulled up by the fish and the ship towed out to sea. Fighting a devilfish is very dangerous, as a blow from one of the huge fins is likely to sink the boat. The safest place for the boat, in the fight, was found to be on the animal's broad back

It is possible to kill one of these monsters, with Mr. Coles' specially devised "spade lance," by a single well-aimed thrust just back of the brain

The "horns" are unfurled (compare opposite page). They are kept constantly moving in the water and aid in feeding, being used, as a hand might be, to sweep food inward

A small devilfish killed by Mr. Coles in June, 1914



Underside of the big devilfish, which measured eighteen feet from tip to tip of the large fins. The tail of a devilfish is normally about as long as the extreme width of the animal

feet as in the lances used on whales. The big drogue kept the fish always near, and for twenty-two minutes we had possibly the most dangerous fight ever fought out successfully on the water with any living creature. The wounded devilfish kept plunging below, then throwing herself half out of the water, and as she followed these maneuvers by short rushes on the surface, accompanied by violent blows, I quickly realized that the safest place for the boat was on the fish's back, and I directed accordingly.

The water was so thick that the *Manta* could not be seen until very near the surface, but Charlie kept the slack of his harpoon hauled in and the line showed the direction in which the fish was traveling under water. Captain Jack steered the boat, which was kept running, and that it was well handled is shown by the fact that not once in more than a dozen rushes did the devilfish reach the surface without finding our boat on her back. Each time I drove the lance through her heart or brain one or more times, and after the fight she showed twenty-three such wounds.

The four-hundred-and-five-calibre Winchester rifle and the big whale gun were in their racks under the cap of the boat, but I did not attempt to use them; a sensation hard to describe, which must be the blood lust of primitive man, makes the hand lance the one weapon of all others that yields the most satisfaction. No matter how frightened or excited a man may be, just let him put every ounce of his brute strength behind the thrust of a hand lance, and all sense of fear leaves him; as he again and again drives home and recovers the lance, every sensation but simple blood lust appears to be dead and he would not trade the lance for any other weapon.

Through all this fight there was one uncertain and disturbing factor that we were not in a position to guard against — namely, that the great male mate of the wounded *Manta* kept near us until the fight was over and three times nearly capsized us by pushing the boat from the back of the female. Once, just after we had been nearly capsized by a heavy blow from the head of the male, and when the female was fighting most

Modeling the Devilfish in the American Museum.— Rough plaster molds of the upper and under sides of Mr. Coles' big devilfish were made on the beach after it had been landed. These were sent to the American Museum in twelve sections, and were put together by Mr. J. C. Bell, who made a cast of the fish from them. The photograph shows Mr. Bell at work upon this cast perfecting it in detail; after which another mold will be made from the perfect cast, and another light cast from the perfect mold. This last cast will be colored, and the model will then be a lifelike representation of the great devilfish in every particular. The tail has not yet been put in place on the model

violently, when we were all covered with the blood of our victim and the boat was almost filled with water, the youngest member of the crew (Luther Dixon), thinking that the end for all of us was near, tried to force a harpoon into my hand as he screamed, "Iron the big bull and let's all go to Hell in tow of a team of devils!" I quote this to show the temper of the men, for while Luther, and probably others of the crew, thought this our last fight, neither he nor any other man showed even a trace of fear. Then the dying *Manta* raised her head against the side of the boat and gave a loud harsh bark or cough, and as I exclaimed, "Watch her eyes looking two ways at once!", the stricken creature slowly rolled one of her eyes, until with that one only, she seemed to look at all of us behind her in the boat.

Before striking the *Manta* I had looked at my watch and called out the time, and as the big fish died, I again pulled it out and asked, "How long?" Not one of the crew placed the time of the fight at less than two hours and when I told them that it had taken only twenty-two minutes, they wanted to see if the watch had not stopped. The fight was now over, the great female *Manta* that we had come for was dead; but there was still a man-sized job in front of us and we at once made the fish fast to our stern and headed for Blind Pass, more than a mile away. We reached it in a little over an hour of hard towing, but then met an ebb tide against which we could make no headway; so making the specimen fast to the beach and leaving three men to keep off sharks with lances, I ran the boat inside and hired another boat to assist with the towing; then returning we made both boats fast and the long tow began.

Just before leaving Blind Pass I looked back out to sea and saw a red-looking dark patch of about two acres in extent on the surface of the water, which had been made by the blood of the *Manta*. This blood had evidently gathered many fishes, for I saw, hovering over and continually pitching into the bloodstained water, a flock of about thirty pelicans.

The distance from Blind Pass to the spot at Captive Inlet where I had planned to make my cast was twelve miles and, with the two boats towing, ten hours and a half were required to make the trip. Long before we reached our destination black night had closed down on us and it was impossible to see any light to steer by. Captain Jack, however, had fished that bay for thirty years and could tell our position by sounding the bottom, but when we were well out near the middle of the bay a violent squall suddenly broke on us, with a roar of thunder, rain and wind, and there were some who wanted to cut loose from the prize, claiming that we could return next morning and recover it. I would not take the chance, and although the wind got up a bad sea and we shipped much water, we kept baling out and by the time we reached the end of our journey the storm had passed. Quickly making the *Manta* fast to the beach and leaving two men on guard we ran the boat the two miles to our living camp and had a few hours of much needed sleep; then with the return of daylight we were all back at work on the specimen.

The rise and fall of the tide on this coast is not sufficient to aid materially in bringing such a fish out of the water so I had materials in place for the work. First we ran three thirty-five-foot, heavy, dock timbers out into the water under the fish; on the top of these were placed five two-and-a-quarter inch turned rollers, and on the top of these, next to the fish, three planks. Two heavy ropes

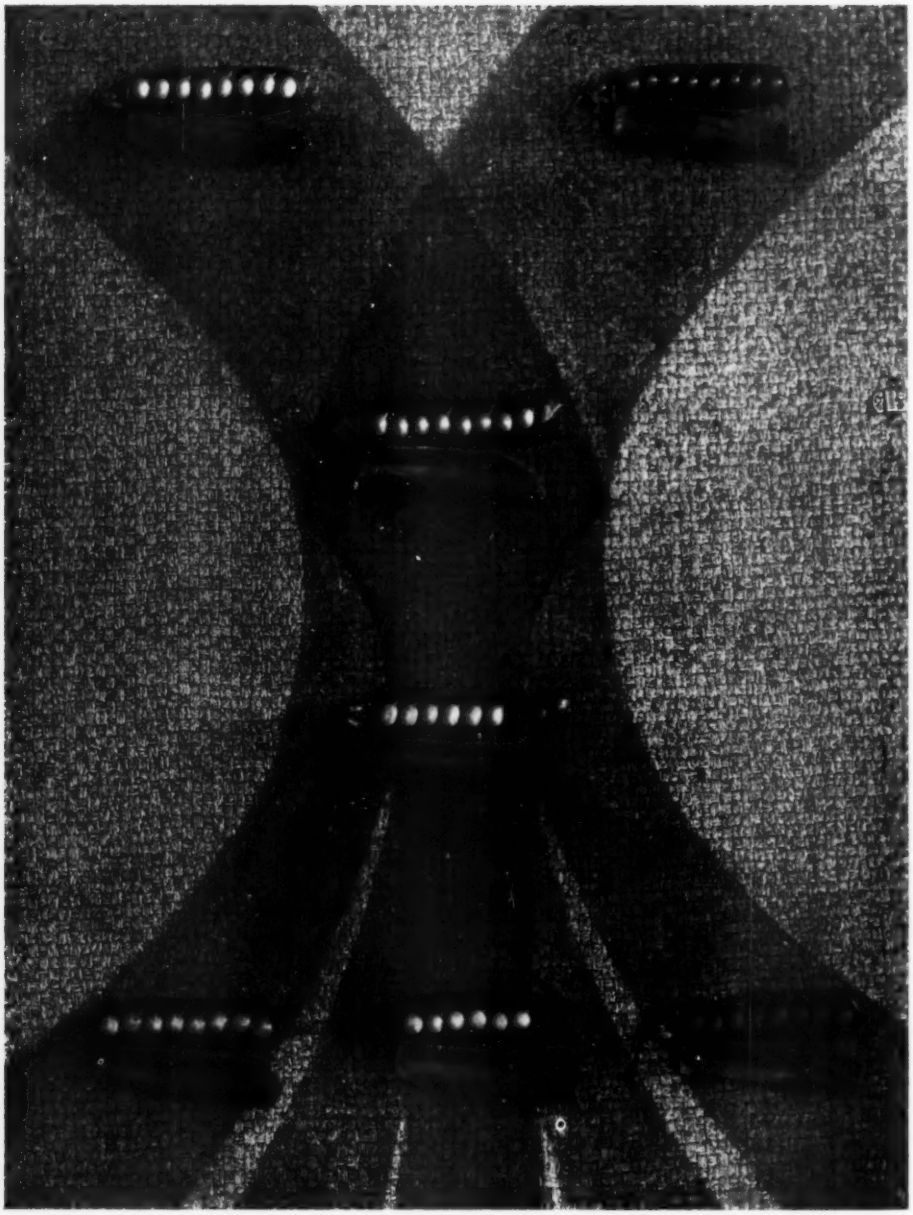
were made fast to the head of the fish and anchored to a tree two hundred yards inland, and I then applied a very powerful device, using man power at the end of a long lever, not unlike the horse power device used in pulling stumps, and slowly the big devilfish came up out of the sea.

I had ready fifteen hundred pounds of plaster of Paris, many bales of excelsior, and a number of barrels of fresh water. I had also erected a twenty-foot tower from which to take photographs and I attempted to hoist the parts of the fish on this tower for weighing; but my weighing device was not sufficiently powerful for obtaining accurately the weight of such a large specimen. The entire day was devoted to making the cast and to preserving parts of the specimen in three hundred gallons of formalin solution.

From the time that I first struck the fish on the morning of April 11, until the photographing, casting, and preserving of the fish were completed on the night of the twelfth, there had been no time to attend to anything else; but on the thirteenth, with a feeling of intense satisfaction, I sent by boat to Punta Gorda a telegram to the American Museum of Natural History telling of the successful issue.

The next few days were devoted to making crates and packing the cast in excelsior. The parts of the specimen were also taken out of formalin solution and packed in excelsior which had been dipped in formalin. The big thirty-five-foot timbers and the rollers were then used in loading the crates on a large boat which had been brought in as close as possible to the beach, and I and my whole crew accompanied them to Punta Gorda and assisted in loading them on a car, addressed to the American Museum.

This drawing by Mr. Albert Operti gives an impression of one phase of the devilfish hunt. Relative dimensions of both fish and men are accurately recorded. The wounded fish, in its rush to the surface, finds the boat on its back; each man is in his appointed place, and the lance is about to be planted



From exhibit in the American Museum of Natural History

INHERITANCE OF COLOR IN PEAS

Mendel's classic experiments were made with the common garden pea (*Pisum sativum*). When peas of yellow seed color were crossed with those of green seed color, the peas of the resulting plants were all yellow. When these yellow peas were mated together the peas of the resulting plants were one-fourth pure yellow seed color, two-fourths yellow hybrids, and one-fourth pure green. Of these the pure yellows and greens bred true, the hybrids continuing to give half hybrids and half pures as before

Heredity and Sex

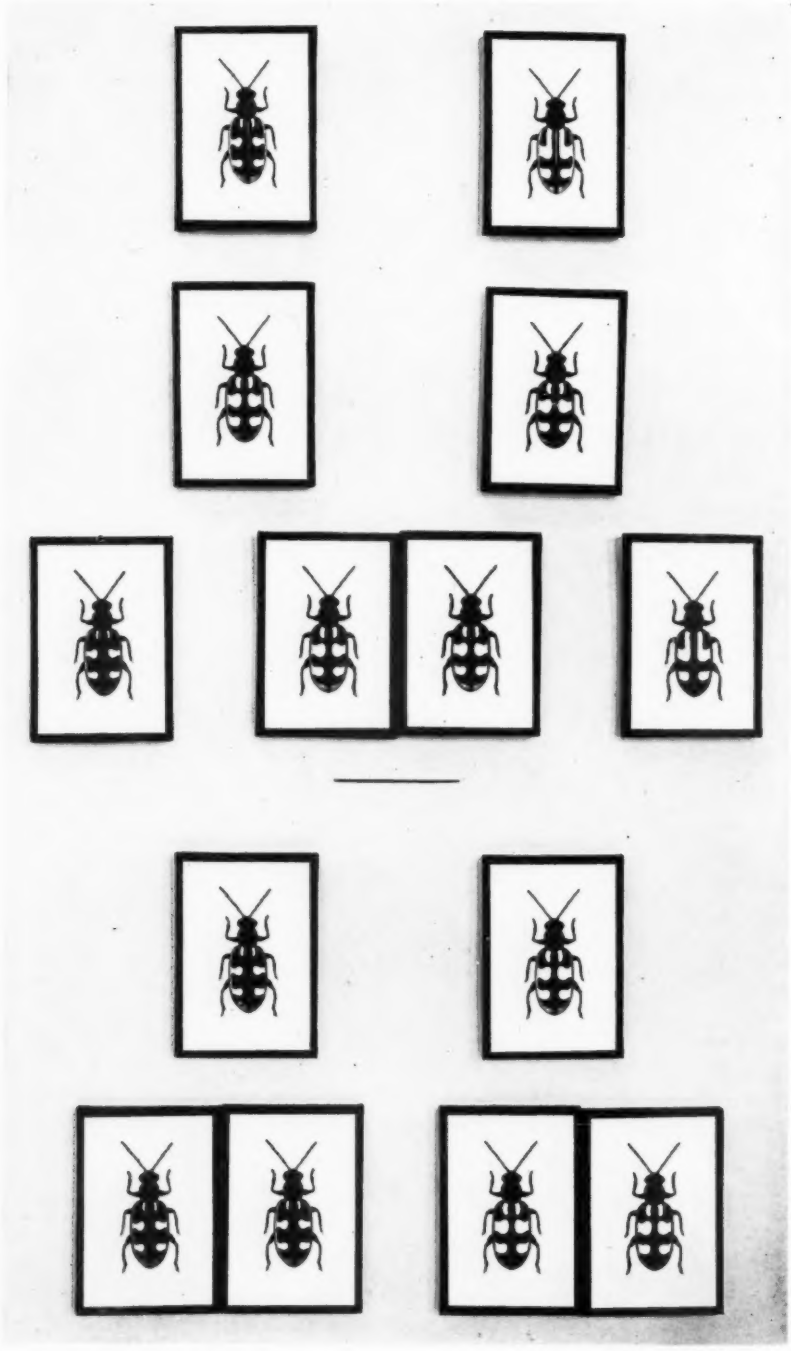
MENDELISM AND SOME OF ITS RECENT DEVELOPMENTS

By FRANK E. LUTZ.

THE history of science is as full of episodes replete with "human interest" as is the history of nations. Not the least of these is the story of Gregor Mendel, a peasant, later a monk, and finally Abbot at Brünn, but now known not for his theology or his kindly deeds to his fellows, but for his patient and successful work in his avocation — the study of heredity. The principal material which he used in this study was the common pea, and his results were published in an obscure journal in 1865. Darwin knew of his work but failed to appreciate its significance. In fact, it remained unnoticed until eighteen years after Mendel had died when, independently but simultaneously, it was brought to our attention, together with important confirmations, by three noted botanists: De Vries, Correns, and Tschermak. Its rediscovery has not only given us a theory of heredity which has revolutionized the practical breeding of plants and lower animals, but also it has given a new impetus to the experimental study of evolution and, through the "eugenics" movement, bids fair to play an important part in the development of human society. It is fitting, therefore, that the American Museum should arrange exhibits illustrating the principles of Mendelism. In the Darwin hall of the American Museum, features of the Mendelian law of heredity are shown by means of peas and rats, while in the insect hall not only Mendelism, but also the later developments of Mendelism — its relation to the mechanism of the germ cell and to sex — are illustrated.

Gregor Mendel, Abbot of Brünn, whose experiments in plant hybridization (1853–1884) led to the formulation of important principles of heredity

As an illustration of Mendelism in its simplest form we may take the following: The commoner of the two beetles — both undesirable immigrants from Europe — which feed upon our asparagus is *Crioceris asparagi*. It is a small green creature with cream-colored markings. In some individuals these markings consist of three small spots on each wing cover; in others these spots are larger, and the two front ones on each side are joined. Now, if an asparagus beetle having the spots small and separate mates with one having the spots large and joined, the offspring (the "hybrids" or, as this



From exhibit, American Museum of Natural History

ILLUSTRATION OF SIMPLE MENDELISM

Inheritance of color pattern in the common asparagus beetle (*Crioceris asparagi*). The upper experiment shows the result of mating a beetle having spots small and separate with one having spots large and joined. The offspring are hybrids, unlike either parent, but if mated with one another half their offspring will be hybrids, one-fourth pure-blooded and like the original female ancestor, and one-fourth pure-blooded and like the original male ancestor. If one of these pure-blooded offspring now mates with a hybrid, the resulting offspring will be half hybrid and half pure-blooded, as shown in the lower experiment

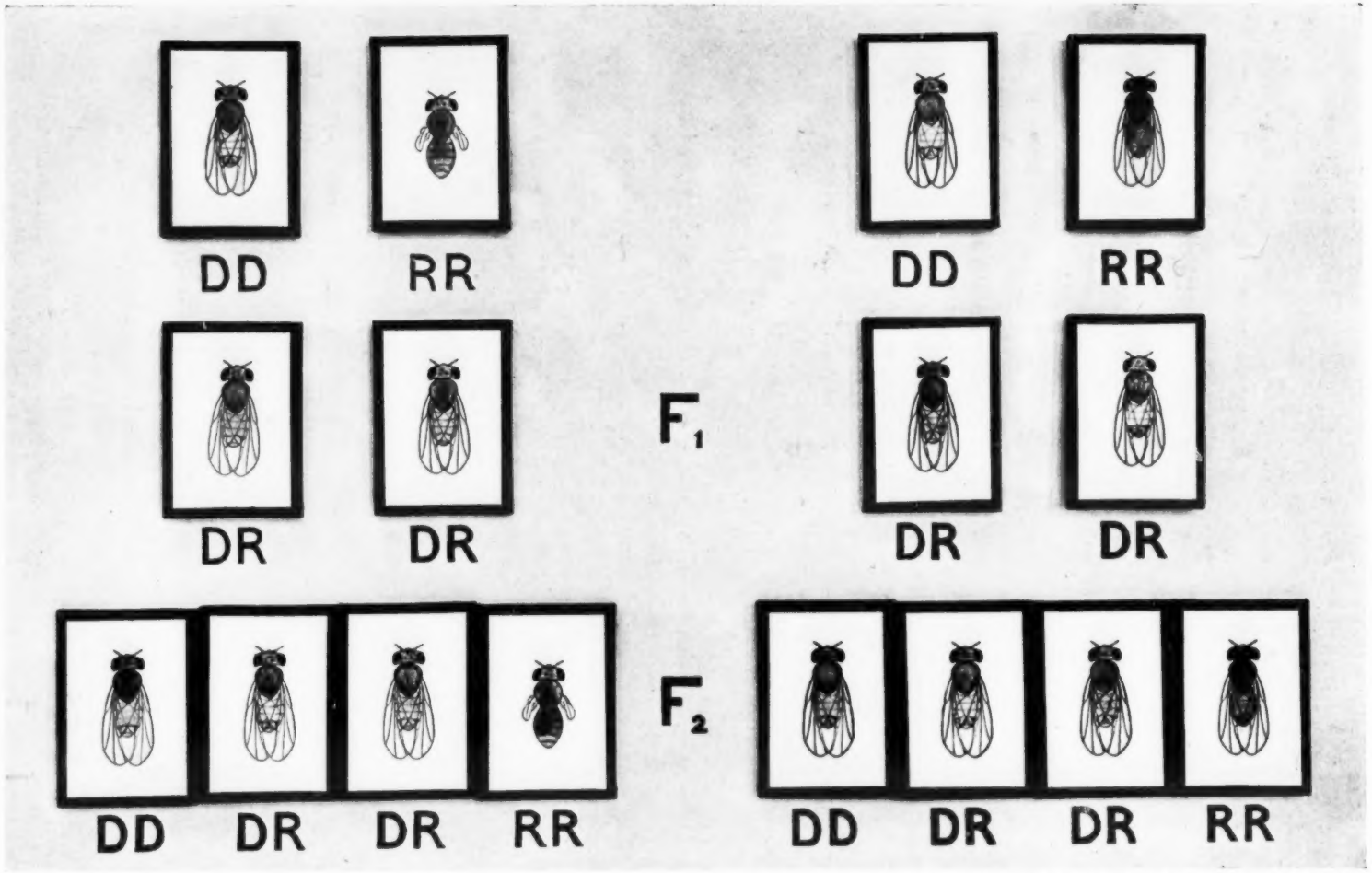
generation is called, F_1) will have the spots large but not joined. If these hybrids mate, the next generation (F_2) will, in the long run, consist of one individual with spots small and separate to two with spots large and separate (hybrids) to one with spots large and joined. This is shown in the insect hall and in the figure on page 230. Half of the F_2 generation are hybrids, and if mated with similar hybrids will give offspring in these F_2 proportions, 1:2:1. The rest are pure. If spots-small-and-separate be mated with spots-small-and-separate all the offspring will have the spots small and separate, no matter what the previous ancestors were. Likewise spots-joined mated with spots-joined can give only spots-joined.

Although this case has not been as thoroughly studied as the others to be mentioned here, it is cited first because it shows clearly which are hybrids. In the others the law of dominance is so prominent that the simplicity of Mendelism is obscured. Let us analyze this case by means of symbols. We will let *S* stand for spots small and separate and *J* for spots joined. As every individual is made up of two parts, maternal and paternal, we will indicate individuals by two letters. The beetles with which we started are therefore *SS* and *JJ*. The former produces germ cells each one of which carries the factor *S*, and each of the germ cells of the latter carries *J*. United, these make a hybrid individual, *SJ*. Now the essential point is that a given germ cell can carry the factor for only one condition of a given character. Therefore hybrid asparagus beetles produce two kinds of germ cells, one bearing *S* and the other *J*. There are equal numbers of each kind. An *S* sperm has equal chances of fertilizing an *S* and a *J* egg, giving equal numbers of *SS* and *SJ* offspring. There are just as many *J* sperm, and they have equal chances of fertilizing an *S* and a *J* egg and therefore we should get a similar number of *SJ* and *JJ* offspring. The total would be one *SS* to two *SJ* to one *JJ*. "Q.E.D."

A further test consists in mating pure individuals with hybrids. *SS* produces only *S* germ cells, and *SJ* equal numbers of *S* and *J* germ cells. Therefore, there will be an equal number of the combinations, *SS* and *SJ*. See page 230.

The ordinary "sour fly" or pomice fly (*Drosophila ampelophila*) has been used more than any other species of animal or plant in the experimental study of inheritance. The two examples used in the insect hall and shown on page 232 are illustrations of simple Mendelism plus the law of dominance. This is a very slight complication and consists merely in the fact that when two characters are joined in the hybrid only one (the "dominant" one) is evident. The "recessive" character is there however, and half of the germ cells produced by such a hybrid bear only the recessive character. If a pomice fly having aborted wings of a certain kind be mated with a pure normal-winged fly, all the offspring (hybrids, or F_1) will have normal wings, for normal wing is dominant and aborted wing is recessive. If these hybrids be mated together we shall get in the F_2 generation, *one* pure normal-winged to *two* hybrid (but having normal wings), to *one* pure aborted-winged. More briefly, the ratio is *three* normal-winged to *one* aborted-winged. Although the eye can not distinguish between the two kinds of normal-winged F_2, breeding shows that they exist in the proportions just mentioned. In the second illustration, normal body color is dominant and black is recessive.

Mendel used peas in his own experiments, and on page 228 is shown part of the exhibit in the Darwin hall illustrating these. The pair of characters concerned is yellow seed color (dominant) and green



From exhibit, American Museum of Natural History

THE LAW OF DOMINANCE

Inheritance of wing length (left) and of color (right) in the pomice fly. When two characters are joined in a hybrid, only one (the dominant one) is evident. Normal wing is dominant to aborted wing and light to dark color, so the offspring from a pure normal and an aborted-winged fly will all have normal wings. The recessive character is present [illegible] in half the sperm cells of each hybrid, and their mating will produce one pure dominant to two hybrids to one pure recessive, the pure dominant and both the hybrids having normal wings. Similarly in the color series

2353

having normal wings. Similarly in the color series

2352

From exhibit, American Museum of Natural History

INHERITANCE OF TWO PAIRS OF CHARACTERS

Since light body color and normal wing are dominant characters, all of the first-generation offspring, from mating a light normal-winged with a dark aborted-winged individual, will be light with normal wings. These hybrids however, will each produce in equal numbers, four different kinds of germ cells. In the third generation there will therefore be four different kinds of individuals, in the ratio of nine light-normal to three light-aborted to three dark-normal to one dark-aborted

seed color (recessive). In order that this case may be understood in its relation to the zoölogical illustrations, it should be noted that seeds are really young next-generation plants. In this exhibit the fact is emphasized that the extracted dominants and recessives of F_2 and subsequent generations, *i. e.* the pure offspring of hybrid parents, are really pure. If mated, each to its kind, they carry on their strain indefinitely.

As illustrations of Mendelism in vertebrates, experiments with the wild gray and domesticated "fancy" rats [1] are exhibited in the Darwin hall. If a pure gray rat be mated with a white rat the offspring will all be gray, for gray is dominant while white is recessive, and in the F_2 generation there will be three grays to one white (see page 235). This white, however, will be pure. Suppose a breeder had only one white rat, but wished to establish a strain. He could mate it with a wild gray, and although the hybrids would all be gray, he could get *pure* white individuals either by mating the original white with one of its hybrid offspring, or by mating hybrids with hybrids. In the former case he would get fifty per cent hybrids to fifty per cent pure white (see the asparagus beetle illustration) and in the latter seventy-five per cent grays (one-third of them pure gray) to twenty-five per cent pure white.

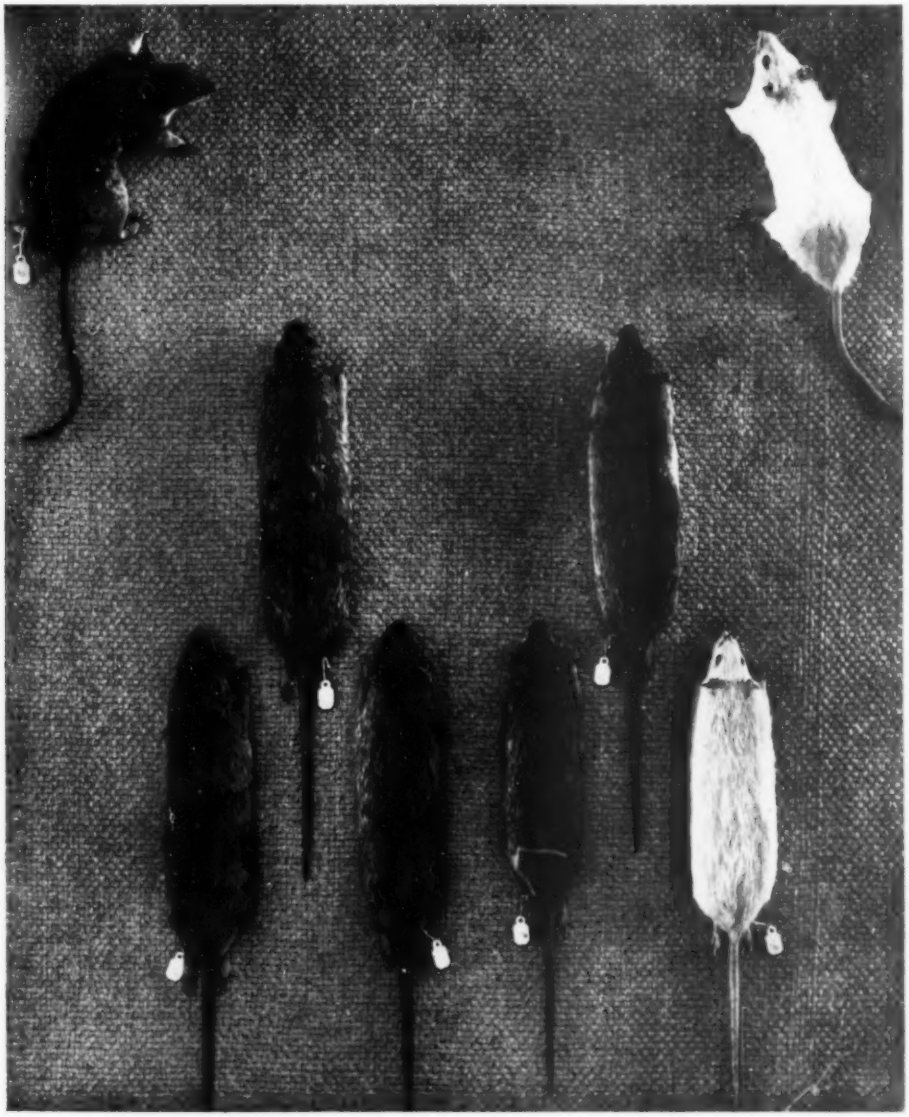
Let us go a step further and consider what happens if there are two independent pairs of characters. In this connection compare page 232 with page 233. On page 233 it is seen that one of the parents has aborted wings and dark body color while the other is normal with respect to each of these characters. Since light body color and normal wing are dominant, all of the F_1 generation are light and have normal wings. In the F_2 generation one-fourth of the offspring have aborted wings, one-fourth have dark body color, while three-fourths have long wings and three-fourths have light body color. However, there are four different combinations in the ratio of *nine* light-normal to *three* light-aborted to *three* dark-normal to *one* dark-aborted. Those acquainted with the laws of chance will see that this is the ratio to be expected if twelve light and four dark (3:1) be independent from, and combined in a random fashion with, twelve long and four aborted. The germinal analysis may be given as follows, *L* standing for light color, *d* for dark color, *N* for normal wing and *a* for aborted wing. The recessive condition of the characters is indicated by the small letters. The one parent, *LLNN*, produces germ cells which are all *LN*. The germ cells of the other parent, *ddaa*, are all *da*. Therefore the offspring will all be *LdNa*. These offspring, male and female, will each produce four kinds, (in equal numbers) of germ cells: *LN*, *La*, *dN* and *da*. Suppose the combinations of letters just given to be eggs, and combine them in a random fashion with the four kinds of sperm: *LN*, *La*, *dN* and *da*. *LN* sperm, fertilizing the various kinds of eggs, would produce equal numbers of *LLNN*, *LLNa*, *LdNN* and *LdNa* individuals. Writing out in like fashion the combinations for the other kinds of sperm and adding the results together, we find we have

1 *LLNN* +2 *LLNa*+2*LdNN*+4 *LdNa*=
9 light-normal,
1 *LLaa*+2 *Ldaa*=
3 light-aborted,
1 *ddNN*+2 *ddNa*=
3 dark-normal,
1 *ddaa*=
1 dark-aborted.

[1] The rats shown are largely from the important experiments of Professor W. E. Castle, of Harvard, who kindly outlined this portion of the exhibit. The rest of the rats were obtained from the N. Y. Zoölogical Park through the courtesy of Mr. Ditmars.

In the case of the rats (page 236) only a sample of each class of F_2 individuals is shown. The ratio is nine black-self-colored to three black-hooded to three yellow-self-colored to one yellow-hooded, for black is dominant over yellow and self-colored over hooded.

There is, theoretically, no end to the number of pairs of characters which may be concerned in any one cross, but the principles are the same: a given germ cell carries but one of each pair, and where both members of a pair come together in the union of two germ cells to form an individual, one of the characters usually dominates over the other.

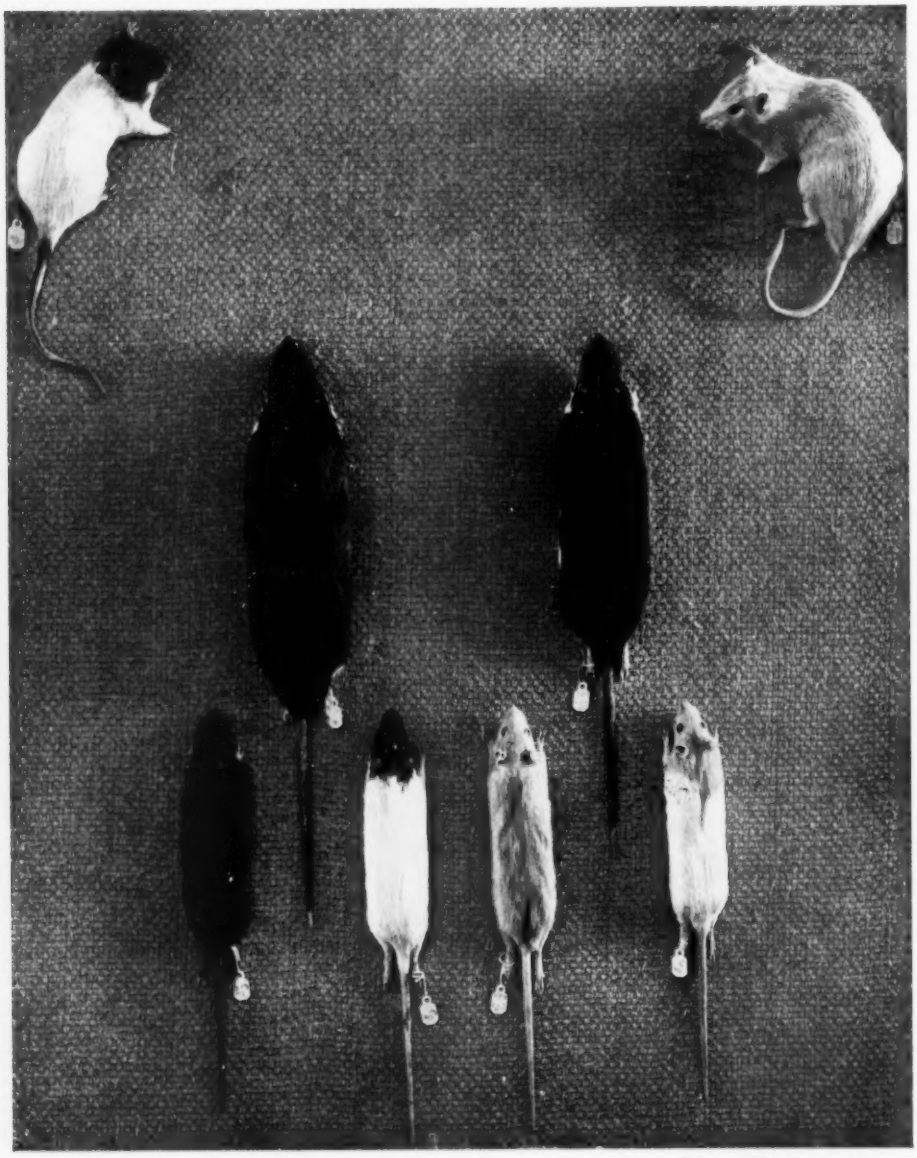


From exhibit, American Museum of Natural History

MENDELISM IN RATS

If a pure gray rat be mated with a white rat the offspring will all be gray, for gray is dominant and white is recessive. In the next generation there will be three grays to one white; the white and one of the grays are pure and will breed true; the other two grays are hybrids.

If three pairs of characters are concerned there will be, typically, eight classes of offspring, in the F_2 generation. This is seen in the third exhibit (page 237) illustrating inheritance of color and pattern in rats where, again, only samples of the various classes are shown. Frequently, as in the case of the rats, the breeder is able, by crossing known varieties, to get new or hitherto unknown varieties in F_2;

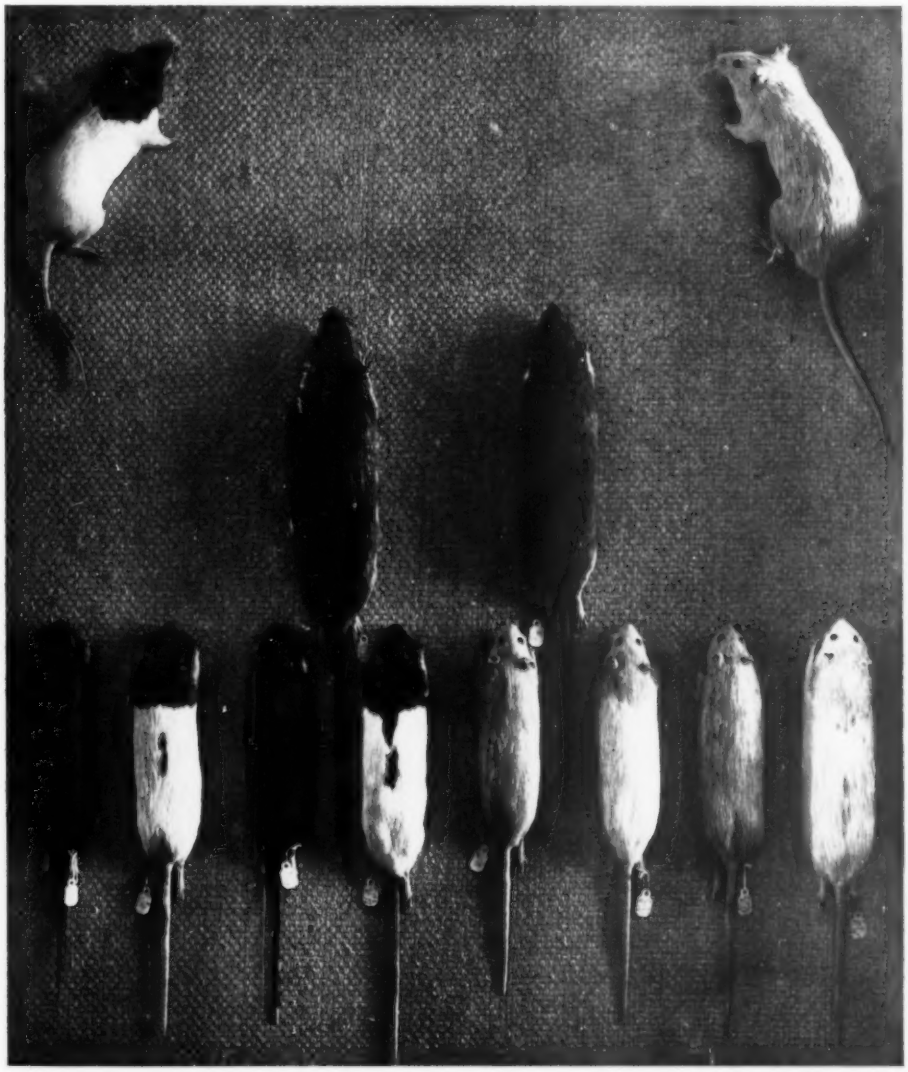


From exhibit in the American Museum of Natural History

DUPLEX INHERITANCE IN RATS

The two pairs of characters here involved are black *versus* yellow, and self-colored *versus* hooded, black and self-colored being dominant, respectively, to yellow and hooded. The first-generation offspring are all gray hybrids, each with four different kinds of germ cells, which produce in the following generation four kinds of individuals, as in the case of the pomice flies. One only of each kind is shown

that is, new combinations are made. The exhibit in the American Museum showing inheritance of flower color in sweet peas, is complicated by the fact that not only are there three pairs of characters, but also that color of any kind, that is any kind but white, can occur only when certain members of two of these pairs come together. One of the white parents had one of these characters and the other had the second; union by crossing gave colored offspring.



From exhibit in the American Museum of Natural History

INHERITANCE OF THREE PAIRS OF CHARACTERS

Where three pairs of characters are concerned in a cross there will be eight classes of individuals in the second generation of offspring. The pairs of characters concerned above are black and cream-colored, yellow and cream-colored, and self-colored and hooded (the condition in which all pigmentation is concentrated near the head). Black, yellow and self-colored are the dominants. The eight classes of offspring (of which only samples are shown) are: black-yellow-self (gray), black-yellow-hooded (white with gray hood), black-cream-self (black), black-cream-hooded (black hood), cream-yellow-self (yellow), cream-yellow-hooded (yellow hood), cream-cream-self (cream) and cream-cream-hooded (cream hood)

Before passing on to the explanation of what may be called the mechanism of Mendelism, a word should be said for the benefit of those who may have read or heard the Mendelian principles given in terms of presence or absence of characters. We may say that a fly's eye is red in the presence of the factor for red, and white in its absence, or we may speak of the pair of characters as red and white. It has seemed better to use the latter alternative here, but the presence-and-absence way of putting it works out well in certain cases and has given rise to some interesting speculations. Thus, Professor Bateson has suggested that all organic evolution has been brought about by the successive dropping out of characters. This seems hard to believe, but certainly the origin of many varieties, whose origin we think we have seen, can be neatly explained in that way.

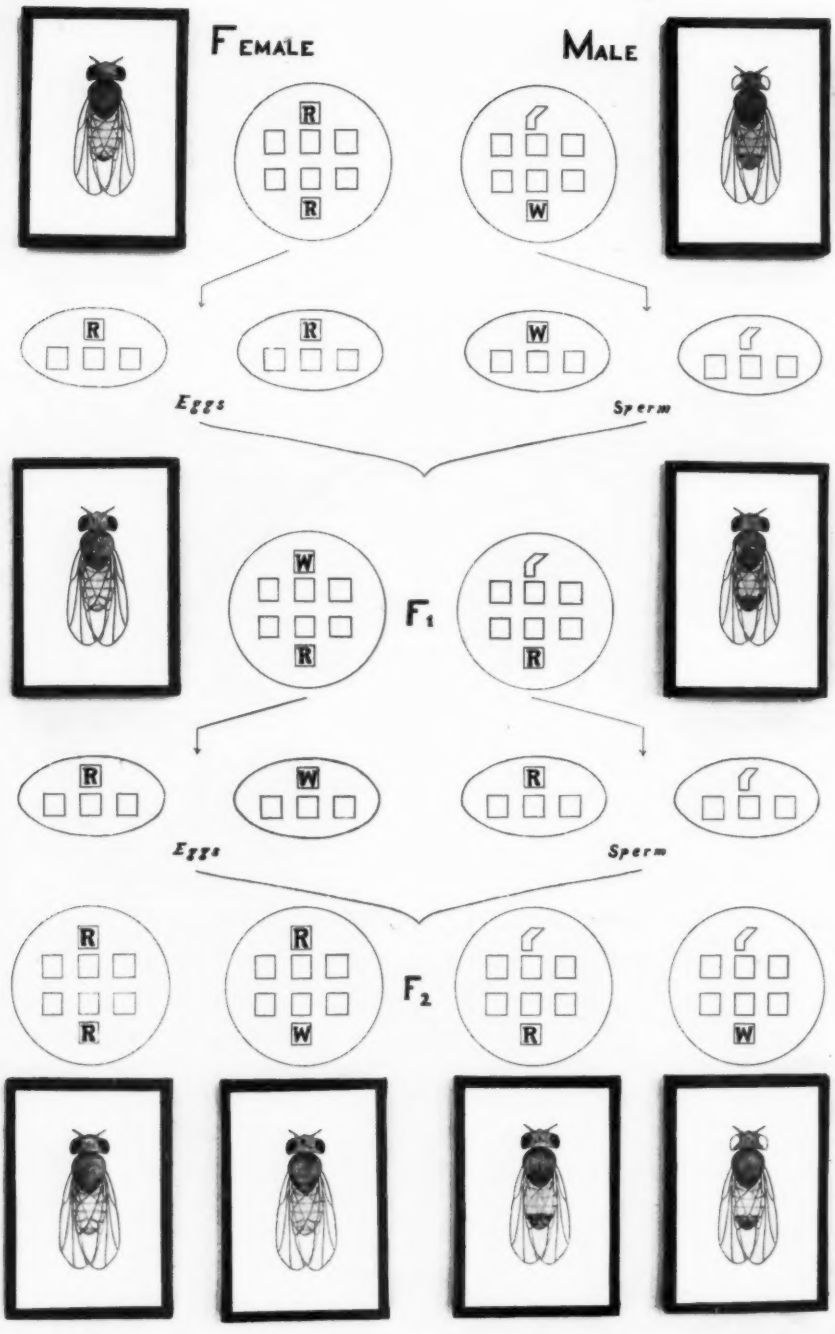
In order to understand the mechanism of Mendelian inheritance it will be necessary to explain some of the details of cell structure. The bodies of all the higher animals and plants are made up of cells, which are frequently looked upon as units of body structure. The lowest animals and plants consist of but one of these cells. The germ cells, egg or sperm, are merely some of these cells split off from the main mass of body cells, and differentiated so that they may unite and form a new mass of body cells, the new individual. In some cases the egg cell can carry on this process without uniting with the sperm, but in the vast majority of cases among higher animals and plants such union is normally necessary. Within these cells are bodies called chromosomes, the name being given because they stain deeply when treated with certain reagents. The chromosomes have, for some time, been supposed to be the bearers of heritable characters, and this supposition has now become almost a certainty by reason of Mendelian studies, especially those with the pomice fly, *Drosophila ampelophila*. We are, as yet, in the dark concerning the exact method by which these characters are transmitted, so that "bearers of heritable characters" is in great part a figure of speech, but, at any rate, these characters are somehow bound up with special chromosomes.

Most, and probably all, organisms have a definite number of these chromosomes, although the number is not always the same in both sexes. In the pomice fly the number is the same (eight) in each sex, but one of the chromosomes (the "Y") of the male seems to carry maleness and not, as far as is known, any other character. When it is present the individual is a male. It is, however, paired in the body cells of the males with a chromosome which does carry factors for certain body characters, and this other chromosome may be called X. In each of the female body cells there is a pair of these X chromosomes but no Y. When a body cell destined to become a germ cell differentiates, the result of the rather complicated process may be stated simply by saying that it breaks in two, making two nearly similar cells. In the case of the male, the Y chromosome goes to one half, *i. e.* to one sperm, and the X chromosome to the other. Each egg has an X chromosome. If a sperm having a Y chromosome enters an egg, the union will have one X and one Y and the resulting individual will be a male. However, if a sperm having an X chromosome enters an egg, the union will have X paired with X; there will be no Y and the resulting individual will be a female. Since the chances are equal that an egg will be fertilized by a Y-bearing sperm or by an X-bearing sperm the determination of sex is a random matter; it depends upon which sperm

enters and not at all upon the mother; and the number of each sex will, in the long run, be equal. All this is, of course, subject to amendment by further investigation, and too sweeping generalizations should not be made, but it, or a similar relation, seems to hold for other strictly bisexual animals and it is the only explanation for the following, among other, facts.

A few pomice flies were found having white eyes instead of red. This white condition is recessive to red but in inheritance the proportions are not those of simple Mendelism. In what has gone before nothing was said about sex, because characters which have been previously mentioned occur without regard to it. This particular eye color however, is one of a number of characters which are "sex linked." If a white-eyed male be mated with a pure red-eyed female (see page 240), all the offspring, both male and female, will have red eyes. If these offspring be mated with one another, all the females of the next generation will have red eyes, but half of the males will have white eyes and only half will have red eyes. On the other hand, if a red-eyed male be mated with a white-eyed female (see page 241), all the male offspring will have white eyes and all the female offspring will have red eyes. This is what has been called "criss-cross" inheritance — the sons being like their mother and the daughters like their father. If these offspring be mated with one another, half of the male and half of the female offspring will have white eyes, the remainder having red eyes.

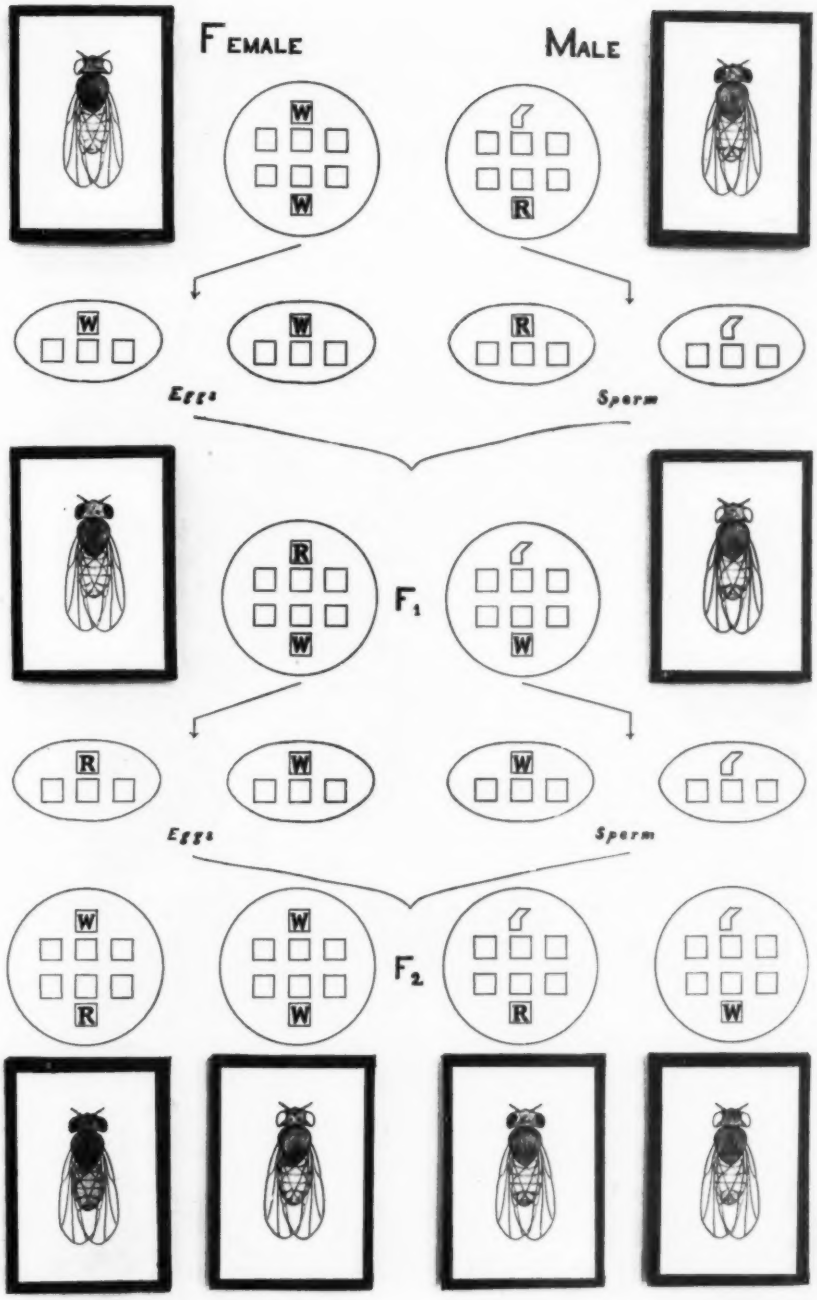
The explanation is as follows: This pair of characters, red eye *versus* white eye, is associated with the X, or sex, chromosome. In the first case mentioned the female was pure with respect to this eye-color character; that is, both of the X chromosomes carried the factor for red eye color (see page 240). The male, since it showed the recessive character, must have been pure with respect to white eye color and, furthermore, all males are necessarily pure with respect to this particular pair of eye colors, and also with respect to all other sex-linked characters, since they have but one X chromosome, and since that chromosome, like any other, can bear the factor for only one of a pair of characters. All of the eggs, in this mating, carried the factor for red eye color. Half of the sperm carried the factor for white eye color and the other half had no factor concerned with this pair of characters. If a sperm bearing the factor for white eye color united with an egg, the offspring would be a hybrid since it contained factors for both eye colors, but, since red is dominant over white in this case, this individual would show the red color. It would also be a female since the union which produced it was with a sperm having an X chromosome. If a sperm not bearing the X chromosome (that is, one with the Y) united with one of the eggs, all of which bore the factor for red eye color, the result would be a male pure with respect to red eye color, since the only factor concerned with this pair of characters came with the egg and was red. In other words, all the females of this generation had red eyes and were hybrids with respect to eye color, while all the males had red eyes and were pure with respect to eye color. Half of the eggs which go to produce the next generation bear the factor for red eye color, and the other half bear the factor for white eye color. Half of the sperm have X chromosomes bearing the factor for red eye color, and the other half have no X chromosomes, and thus have no influence upon eye color. Taking up the first class of sperm, namely, those



From exhibit, American Museum of Natural History

SEX-LINKED INHERITANCE

White eye color in the pomice fly is one of a number of characters which are sex-linked. The diagram represents the chromosomes of the pomice fly, circles referring to body cells and ovals to germ cells. The sex chromosomes are shown above and below the ordinary chromosomes (see text), the factor for eye color which each one carries being indicated by an initial. The odd-shaped figure is the "Y" chromosome. When this is present the individual is a male



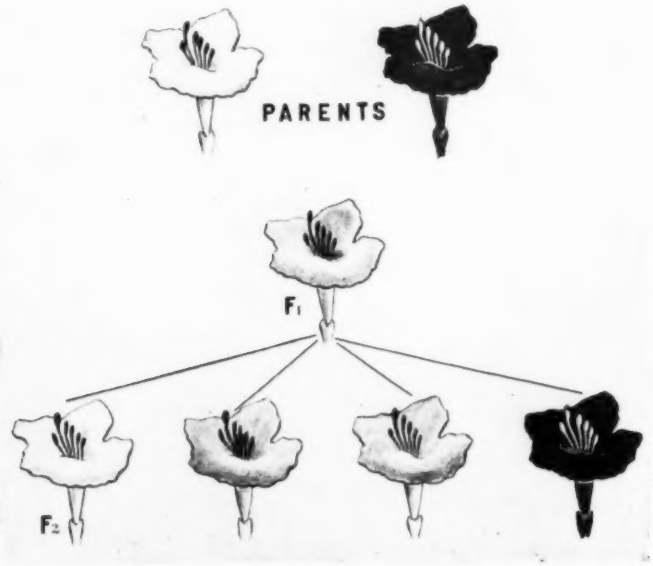
From exhibit, American Museum of Natural History

"CRISSCROSS", SEX-LINKED INHERITANCE

If a red-eyed male be mated with a white-eyed female, all the male offspring will have white eyes and all the female offspring red eyes; if these be mated with one another, half of the male and half of the female offspring will have white eyes, the remainder having red eyes

bearing the X chromosomes: they will, when uniting with an egg, produce female individuals and, since half of the eggs have the factor for red while the other half have the factor for white, half of the resulting females will be pure red, while the other half will be hybrid, but will have red eyes because red is dominant over white. In other words, all of the females of this generation show red eyes. When the sperm lacking X chromosomes unites with the eggs, half of which have the factor for red in their X chromosomes and the other half white, the result will be males, half of which will be pure red and the other half of which will be pure white. This gives us the result stated above; namely, all the females and half of the males red-eyed while the other half of the males are white-eyed. This case may perhaps be more readily understood by reference to page 240, and page 241 shows the details of the second case mentioned above, which involves what is known as "criss-cross" inheritance.

The relatively complicated "sex-linked" inheritance just explained became simple when the explanation was found, and comes near to demonstrating that there is a relation between heritable characters and chromosomes. It would probably be carrying scientific scepticism too far to continue doubting that it is a causal relation. Ordinary Mendelian characters, that is, those which come out in F_2 in the 3:1 ratio, are related to or borne by the ordinary chromosomes, that is, those chromosomes which are alike and paired in each sex. The interested reader may make diagrams, similar to the ones given here, which will show the mechanism graphically. Now that we think we know where the something which transmits a given character lies in the germ cell, we begin to wonder harder than ever what that something is and how it does it. A number of big steps have been taken in the explanation of heredity and, although the goal is still far ahead, by looking back over the ground already covered we are encouraged to believe that it will finally be reached.



Simple Mendelism illustrated by cross between white and red races of *Mirabilis Jalapa*, giving pink hybrids in F_1, which when inbred give one white to two pink to one red

Courtesy of Columbia University Press

Fossil Coral of the Devonian Period 1600 B.C.
Amethystine Quartz About 2000 B.C.
Lapis Lazuli About 2000 B.C.
Anhydrite
Banded Agate
Hematite
Amethystine Quartz Probably Assyrian of 700 B.C.
Lapis Lazuli 2000 B.C. or earlier
Aragonite-banded
Black Serpentine, hard and compact Seals of this type are generally as old as 2040 B.C.
Marble, discolored by fire About 250 B.C.
Jasper Agate As late as 600 B.C.
Aragonite Probably as old as 2000 B.C.
Rock Crystal About 1200 B.C.
Serpentine (banded) Probably as early as 2000 B.C.
Ferruginous Agate
Shell 2000 B.C. or earlier
Jasper, banded red and black
Chalcedony, Blue Sapphire About 700 B.C.
Agate (banded) Assyrian of about 700 B.C.

From "The Magic of Jewels and Charms," by George F Kunz. Courtesy of J. B. Lippincott Company, Philadelphia.

ILLUSTRATIONS OF ACTUAL PRECIOUS STONES AND MINERALS USED FOR SEALS IN ANCIENT ASSYRIA AND BABYLONIA

Mostly from the Morgan-Tiffany collection in the American Museum of Natural History, New York City.

"The Magic of Jewels and Charms"

A BOOK THAT OPENS VISTAS OF ETHNOLOGICAL AND ANTIQUARIAN RESEARCH

By HERBERT J. SPINDEN

IN his newly published book,[1] Dr. George F. Kunz combines his authoritative statements on precious stones as such, with a wealth of literary, ethnological and antiquarian detail. While charming the casual reader with an easy style and an ever-changing subject matter, he presents his scientific facts in a fashion that is fundamentally methodical. Moreover, he gives so many definite references to scientific papers and first descriptions that he appears to open the gates of research rather than to close them. There is often something dismally definitive about a book written by a recognized authority, in that the evidence upon which the conclusions are based may be stated so broadly that it cannot be tested or contested. The dictum of unbending authority is like the word of the Prime Minister, which may not be answered even when it fails to convince.

Jewels are precious because we make them so and not because they minister to our animal needs. But outside of the absolute æsthetic interest in color, clarity and fine craftsmanship, and the commercial interest of rarity, there still remains in our days a romantic and superstitious interest, coming down from times when jewels and charms were believed to have use as well as beauty. Among all primitive and most civilized peoples many stones are regarded with superstitious reverence for their magical properties.

[1] THE MAGIC OF JEWELS AND CHARMS. By George Frederick Kunz. 8vo., pp. xv + 422, and 90 illustrations in color, doubletone and line. J. B. Lippincott Company, Philadelphia.

Magic stones are not gems alone, but under this name are included such fabulous wonders as the statue of Memnon at Thebes, which greeted the dawn with vocal and musical notes. According to early belief, the sarcophagus was a stone cyst that consumed the body of the dead person placed within it, or perhaps caused this body to turn to stone. Many stones were regarded as having special curative properties, usually in accordance with the primitive doctrine that like cures like, studied by anthropologists under the broader manifestations of "sympathetic magic." Thus galactite (nitrate of lime) was connected with the idea of mother's milk because a solution of it greatly resembles milk. In many cases, however, the magical character does not seem to depend upon a quality of similarity so much as upon a quality of test and apparent success. Many fetishes, or luck stones, belong in this category. Often these are peculiar pebbles found under the guidance of a dream and kept by the finder as a symbol of his luck. Sometimes these fetishes suggest some animal or object, and then take over the proper character or special favor of the animal or object suggested. The philosophical corollaries of the fetish or charm-stone idea are often very interesting. It seems almost impossible to separate stones that have curative properties from those that have broader talismanic virtues.

When the more strictly religious use of various stones is taken up in the book, we are led through the mazes of pagan and Christian ceremonies; we have ac-

By courtesy of
J. B. Lippincott Company

PEBBLES FROM CALIFORNIA BEACHES

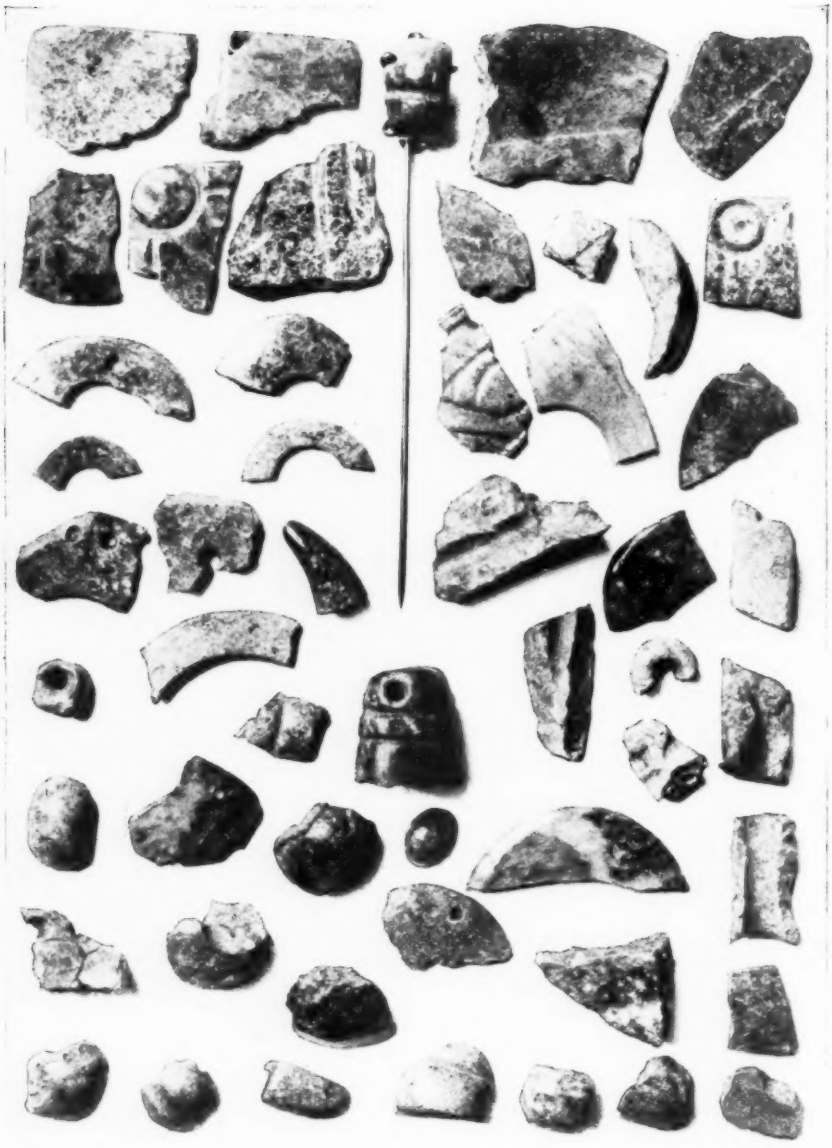
Pebbles from Pescadero Beach, San Mateo County, California. The California beaches have furnished some very interesting ornamental pebbles, chiefly of chalcedony or agate, a few of jasper or fossil coral. Centuries ago the Indians of this region valued them as talismans or amulets

Searching for semi-precious pebbles at Redondo Beach, Los Angeles County, California

By courtesy of
J. B. Lippincott Company

OLD HINDU WEARING ANCESTRAL PEBBLES AS AMULETS

Stones and pebbles of little intrinsic value but supposedly with occult powers, are handed down from father to son in Hindu families of the poorer class



By courtesy of
J. B. Lippincott Company

CARVED AND WORKED STONES FROM THE SACRED WELL AT CHICHEN-ITZÁ

Near the great temple pyramid at Chichen-Itzá, Yucatan, Mexico, is the Sacred Way, traversed in times of tribulation by processions of priests bearing ornaments and trinkets, which are thrown into the Sacred Well at the end of the way as peace offerings to the gods. Fragments of carved stone ornaments recovered from the well indicate a high development of artistic skill and lapidarian art among the ancient Mayas

The Oryx.

The Crocodile.

A Fish.

Hippopotamus.

By courtesy of
J. B. Lippincott Company

FLINT AMULETS OF THE PRÆDYNASTIC PERIOD, EGYPT

The chipped stone implements of prehistoric man are regarded with superstitious reverence in many parts of the world. In Ireland the flint arrow-head is believed to have been shot at man or beast by the fairies and to protect the wearer against injury from them; the Scandinavian peasants share with the Burmans a delusion almost universal among primitive people, that these prehistoric stone implements have fallen from the sky and are charms against lightning

By courtesy of J. B. Lippincott Company

Various animal concretions were at one time believed to contain a quintessence of the nature of the animal in which they occurred. Magic jewels were supposedly extracted from the fabled dragons of India (see first illustration); toadstones were much sought after as antidotes for poisons (second picture), and various animal "bezoar" stones were administered for various ills (see drawing at bottom). Cuts taken from Johannis de Cuba's *Ortus Sanitatis*, Strassburg, 1483, and used here through the courtesy of J. B. Lippincott Company

counts of church treasures, of the origin of rosaries, and of many ritualistic observances of primitive peoples. The student of American archæology will find references to turquoise and jet among the Pueblo Indians of the Southwest, to jade carvings and mosaic inlays of semiprecious gems among the natives of Mexico and Central America, as well as to peculiar ceremonies in which gem stones were employed, such as the sacrifices at the Sacred Cenote in Chichen-Itzá, Yucatan, and at Lake Guatavita in Colombia.

The scope and divisions of subject matter in Dr. Kunz's new book are indicated by the list of chapter titles:

I. Magic stones and Electric Gems
II. On Meteorites, or Celestial Stones
III. Stones of Healing
IV. On the Virtues of Fabulous Stones, Concretions and Fossils
V. Snake Stones and Bezoars
VI. Angels and Ministers of Grace
VII. On the Religious Use of Various Stones
VIII. Amulets: Ancient, Mediæval and Oriental
IX. Amulets of Primitive Peoples and of Modern Times
X. Facts and Fancies about Precious Stones

As an example of printing the book leaves little to be desired. The JOURNAL is privileged to make use of one of the color plates showing objects of particular interest to the members of this institution, because the specimens represented are mostly contained in the Museum's collections. The seals of ancient Assyria and Babylon, bearing the signatures of rulers, are carved in shell, quartz, agate and marble as well as in lapis lazuli, Amazon stone and other material of greater value, and this is one of the most complete collections representing the precious stone materials in ancient Assyria and Babylonia. These seals can now be dated with considerable accuracy and some are as old as three thousand years before Christ.

The White Rat and Sleeping Sickness

By R. W. TOWER and C. F. HERM

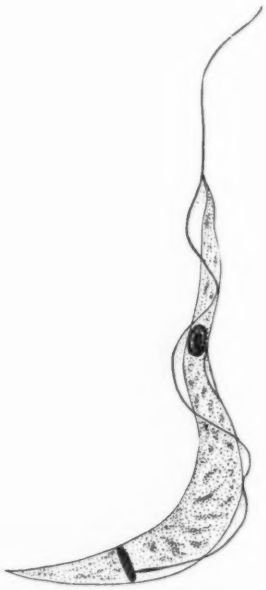
THE following observation made in the physiological laboratory of the American Museum has general interest because of its connection with that dire disease of man, sleeping sickness. A domestic white rat, one of the kind so frequently kept as a pet, was brought to our laboratory a few days ago with a statement from the owner that the small creature seemed to be sick. Under observation he became less active each day, sitting continually in a sleepy attitude as if dazed and utterly oblivious to the excitement or turmoil in his neighborhood. Occasionally he would waken to eat or would change his position in a lackadaisical manner if physically disturbed. After a few days of increasing drowsiness an endless sleep overtook him.

We were asked to explain the malady which killed the rat and among the various examinations that were made, a drop of blood was observed under the microscope. The answer was there, for besides the usual red and white cells in the blood plasma, there were myriads of minute animals many times longer than broad, lashing their way around, hurrying here and there, pushing aside the white cells and piling up the red ones until they resembled rows of pennies standing side by side. Such battling! Like schrapnel from an exploding shell! How could any living cell withstand such an ordeal? What must be the nature of these wild, wiggling, microscopical creatures? To the novice they would appear like tiny eels escaping from a foe. Their activity is indeed so vivacious that it is scarcely possible to make out the structure of the organism. Close observation reveals the form and appearance of a "trypanosome," a name which itself means a "boring body" and rather uniquely describes one component of their mode of propulsion. They are a representative

View of a drop of blood under the microscope, showing normal blood constituents and, in addition, many minute parasitic animals which continually lash their way through the plasma. These are the parasites which in man produce the fatal sleeping sickness so dreaded in certain districts of Africa

of that class of blood parasites which produce in human beings the fatal sleeping sickness in those districts of Africa where the tsetse fly abounds.

Examine under many magnifications these trypanosomes which have been killed and stained with suitable aniline



Trypanosome greatly enlarged. It shows a "basic granule," or blepharoplast near the posterior end, a round nucleus set near the middle of the granular body, a vibratile flagellum like a minute whip lash at the head. The Trypanosome feeds upon the liquid plasma of the blood, first reaching the blood through the bite of a flea, tsetse fly or other blood-sucking insect

dyes and you will find a most interesting structure typical of this class of the one-celled animals known as the protozoa. The whip-like projection or flagellum indicates the anterior portion of the animal, which however is capable of moving both forward and backward. This flagellum, an ever active vibratile whip, is a motor organ which runs back like a chord over a clear, more or less transparent, undulating membrane ending in a darkly stained granule. This structure technically called the "blepharoplast" has the function of governing the motility of the organism, while the larger, heavily stained area above — the nucleus — superintends the vegetative activities of the cell. In this vegetative process our trypanosome apparently lives on the liquid plasma of the blood. The corpuscles are not directly attacked, suffering only physical injury, yet who can predict what poisonous substance the trypanosome may produce which in turn will prove detrimental to the activities of one or another tissue of its host.

That the parasite first reached the blood of this rat by the bite of a flea is most probable, since these blood-sucking insects were abundant in its hair and there waiting again to carry the inoculation to another unsuspecting rodent.

Trypanosomes are widely distributed over the whole world, they attack all classes of vertebrates and while the great majority have no apparent effect upon their hosts, especially the cold-blooded forms, yet among warm-blooded animals they are, in certain cases, the most deadly parasites known to science. They are carried from one host to another by the bite of many blood-sucking insects, although cases are recorded where infection has been transferred in a direct way, as through the food, or by immediate contact with the uninjured skin.

Restoration by G. Howard Short *Courtesy of Aëronautical Journal*

A Reptilian Aëronaut

A NEW SKELETON OF PTERANODON, THE GIANT FLYING REPTILE OF THE CRETACEOUS PERIOD

By W. D. MATTHEW

THE American Museum has recently purchased a remarkably fine skeleton of the *Pteranodon*, or giant pterodactyl, found in the Kansas chalk formation by Mr. Handel T. Martin. It is believed to be the most complete single individual of the giant form yet discovered, and was about twenty feet from tip to tip of the wings. One hind leg, the tip of one wing, and most of the skull and jaws are missing, otherwise it is practically complete. The skeleton will take some time to prepare and mount suitably before it can be placed on exhibition.

These gigantic flying reptiles are the most extraordinary of all extinct animals. They surpassed the largest living birds in spread of wings, although with much less bulk of body. Their habits and method of flying were different from those of birds, and in many particulars are still a puzzle. They had no feathers, but a wing membrane like the bat, only it was stretched on a single enormously long digit instead of upon five. The construction of the wing finger shows that they must have depended almost entirely upon soaring in their forward flight. The flight of the albatross and other long-winged sea birds affords the nearest analogy. The wings could not be folded back against the body as in birds; the shoulder and elbow were hinge joints allowing only of movement up and down; the movements at the wrist joint were more complex, but were concerned chiefly with the rotating upward and downward of the wing plane, in association with the stretching and backward flexing of the wing; the knuckle joint, halfway out upon the wing, allowed of sharp backward flexure, and at this joint were three hooked claws (the remains of the other digits)

which served, presumably, to enable the creature to cling to trees or rocks, or to hang from cliffs or boughs when resting.

The head is converted into a great vertical fin, used no doubt in directing the flight; the huge, straight, compressed bill in front, and a great crest projecting backward from the occiput to balance it. The hind legs are long but not very stout, and the tail is reduced to a mere rudiment. The body is disproportionately small, smaller than in most large birds, and the bones are hollow shells scarcely thicker than a visiting card. As a consequence they are crushed completely flat in fossil skeletons, and the true forms and relations are very difficult to reconstruct.

So far as has been made out by studies of palæontologists and aëronautical experts,[1] the pteranodons, while much more specialized for soaring flight than are any modern birds, were more limited in their movements. They were incapable of the poise-flapping and plunging dive so characteristic of the kingfisher; the wing muscles were too weak for the first movement, and inability to fold the wings backward prevented the headlong dive. Their construction was too delicate to allow of sudden changes of speed. It is not clear that they could venture to dive at all, in view of the apparent difficulty they would have in rising from the water, save in calm weather. Yet there is no doubt that they were accustomed to fly far out at sea, for their remains are chiefly found in the chalk beds of western Kansas, deposited far out in the great interior sea of the Cretaceous period, over a hundred miles from the nearest shore line at that time. They are supposed to have fed chiefly upon fish, which they might obtain by skimming at high speed close to the water and darting the great bill down to pick up objects close beneath the surface. In view of the extreme lightness of the body and hollowness of the bones, it is somewhat surprising that skeletons are ever found in these offshore chalk formations. One would rather expect that they would float upon the surface until, if not devoured, they disintegrated and dropped apart, and that the bones would always be found scattered over the bottom, as indeed they generally are. Possibly the occurrence of associated skeletons is to be explained as due to the animal having been seized by a marine reptile or fish and dragged down into deep water, causing the air-filled bones to collapse and the carcass thereby to become water-logged. If its captor then dropped it by accident or was tempted by some more alluring prey, the pteranodon, or what was left of it, might sink rapidly down to the bottom and be buried under the soft ooze.

On land these animals must have been singularly awkward and inept. They might rest upon the knuckle joints of the flexed wings, but could not walk upon them, since the shoulder and elbow joints did not permit of any fore-and-aft movement. They could not fold the wings backward and walk upon the hind limbs, and if they were able to walk upright upon the hind limbs at all, which is doubted by the best authorities, it must have been with the wings uplifted and flexed in the middle in a very singular pose, difficult to balance properly, if indeed it was possible. Nests or roosting places of some sort they must have had, but of these and of the birth or early development of the young nothing is known, and a wide field is left for conjecture as to the life and habits of these strangest of extinct animals.

[1] See especially articles in the *Aëronautical Journal*, October, 1914, by Dr. E. H. Hankin, Prof. D. M. S. Watson, and Mr. G. Howard Short.

The Traffic in Feathers[1]

AN ACCOUNT OF THE METHODS OF THE FEATHER TRADE IN MEETING THE DEMANDS OF FASHION, AND THEIR EFFECTS ON THE BIRD LIFE OF THE COUNTRY

By T. GILBERT PEARSON

Secretary, National Association of Audubon Societies

TRAFFIC in the feathers of American birds for the millinery trade began to develop strongly about 1880 and assumed its greatest proportions during the next ten years. The wholesale milliners, whose business and pleasure it was to supply these ornaments for women's hats, naturally turned for their supply first to those species of birds most easily procured. Agents were soon going about the country looking for men to kill birds for their feathers, and circulars and handbills offering attractive prices for feathers of various kinds were mailed broadcast. The first great onslaughts were made on the breeding colonies of sea birds along the Atlantic Coast. On Long Island there were some very large communities of terns and these were quickly raided. The old birds were shot down and the unattended young were necessarily left to starve. Along the coast of Massachusetts the sea birds suffered a like fate. Maine, with its innumerable outlying rocky islands was, as it is today, the chief nursery of the herring gulls and common terns of the North Atlantic. This fact was soon discovered and thousands were slaughtered every summer, their wings cut off, and their bodies left to rot among the nests on the rookeries.

During a period of seven years, over five hundred thousand skins of the tern, or sea swallow, were collected in spring and summer in the sounds of North and South Carolina. These figures I compiled from the records and accounts given me by men who did the killing. Their method was to fit out small sailing vessels on which they could live comfortably, and cruise for several weeks; in fact they were usually out during the entire three months of the nesting period. That was the time of year that offered best rewards for such work, for then the feathers bore their brightest luster, and the birds, being assembled on their nesting grounds, could easily be shot in great numbers. When dead, the custom was to skin them, wash off the blood stains with benzine, and dry the feathers with plaster of Paris. Arsenic was used for curing and preserving the skins. Men in this business became very skillful and rapid in their work, some being able to prepare as many as one hundred skins in a day.

Frequently, millinery agents from New York would take skinners with them, and going to a favorable locality they would employ local gunners to kill the birds, which they in turn would skin. In this way one New York woman, with some assistants, collected and brought back from Cobb Island, Virginia, ten thousand skins of the least tern in a single season.

Into the swamps of Florida word was carried that the great millinery trade of the North was bidding high for the feathers of those plumed birds which gave life and beauty even to its wildest regions. It was not long before the cypress fastnesses were echoing to the roar of breechloaders, and cries of agony from the birds were heard even in the remotest depths of the Everglades, while piles of torn feathers became common sights everywhere. What mattered it if the tropical birds of exquisite plumage were swept from existence, if only the millinery trade might prosper?

The milliners were not content to collect their prey only in obscure and little-known regions, for a chance was seen to commercialize the small birds of the forests and fields. Warblers, thrushes, wrens, in fact all those small forms of dainty bird life which come about the home to cheer the hearts of men and women and gladden the eyes of little children, commanded a price if done to death and their pitiful remains shipped to New York.

Taxidermists, who made a business of securing birds and preparing their skins, found abundant opportunity to ply their trade. Never had the business of taxidermy been so profitable. For example, in the spring of

[1] By the courtesy of Mr. T. Gilbert Pearson this chapter from his book *A Manual of Bird Study*, to be published shortly by Doubleday Page and Company, is given advance publication in the JOURNAL.

1882, some of the feather agents established themselves at points on the New Jersey coast, and sent out word to residents of the region that they would buy the bodies of freshly killed birds of all kinds procurable. The various species of terns, which were then abundant on the Jersey coast, offered the best opportunity for profit, for not only were they found in vast numbers, but they were also comparatively easy to shoot. Ten cents apiece was the price paid, and so lucrative a business did the shooting of these birds become that many baymen gave up their usual occupation of sailing pleasure parties and became gunners. These men often received as much as a hundred dollars a week for their skill and prowess with the shotgun.

It is not surprising that at the end of the season a local observer reported: "One cannot help noticing now the scarcity of terns on the New Jersey coast, and it is all owing to the merciless destruction." One might go further and give sickening details of how the birds were swept from the mud flats about the mouth of the Mississippi, the innumerable shell lumps of the Chandeleurs, and the Breton Island region. How the Great Lakes were bereft of their feathered life, and the swamps of the Kankakee were invaded. How the white pelicans, western grebes, Caspian terns, and California gulls of the West were butchered, and their skinned bodies left in pyramids to fester in the sun. One might recount stories of bluebirds and robins shot on the very lawns of peaceful, bird-loving citizens of our Eastern States, in order that the feathers might be spirited away to glut the never-satisfied appetite of the wholesale dealers. Never in this country have birds been worn in such numbers as in those days. Ten or fifteen small song birds' skins were often seen sewed on a single hat.

In 1886, Dr. Frank M. Chapman of the American Museum, walked through the shopping district of New York City on his way home two afternoons in succession, and carefully observed the feather decorations on the hats of the women he chanced to meet. He found, in common use as millinery trimming, many highly esteemed birds, as the following list which he wrote down at the time will serve to show: Robin, brown thrush, bluebird, Blackburnian warbler, blackpoll warbler, Wilson's black-capped flycatcher, scarlet tanager, white-bellied swallow, Bohemian waxwing, waxwing, great northern shrike, pine grosbeak, snow bunting, tree sparrow, white-throated sparrow, bobolink, meadow lark, Baltimore oriole, purple grackle, bluejay, swallow-tailed flycatcher, kingbird, kingfisher, pileated woodpecker, red-headed woodpecker, golden-winged woodpecker, Acadian owl, Carolina dove, pinnated grouse, ruffed grouse, quail, helmet quail, sanderling, big yellowlegs, green heron, Virginia rail, laughing gull, common tern, black tern and grebe.

This was a period when people seemed to go mad on the subject of wearing birds and feathers. They were used for feminine adornment in almost every conceivable fashion. Here are two quotations from New York daily papers of that time, only the names of the ladies are changed: "Miss Jones looked extremely well in white with a whole nest of sparkling scintillating birds in her hair which it would have puzzled an ornithologist to classify." and again, "Mrs. Robert Smith had her gown, of unrelieved black, looped up with black birds; and a winged creature, so dusky that it could have been intended for nothing but a crow, reposed among the curls and braids of her hair."

Ah, those were the halcyon days of the feather trade! Now and then a voice cried out at the slaughter, or hands were raised at the sight of the horrible shambles, but there were no laws to prevent the killing nor was there any crystallized public sentiment to demand a cessation of the unspeakable orgy, while on the other hand more riches yet lay in store for the hunter and the merchant. There were no laws to protect these birds nor was there, for a time, any forceful man in evidence to start a crusade against the evil.

The most shameless blot on the history of America's treatment of her wild birds has to do with the white egrets. From the backs of these birds come the "aigrettes" so often seen on the hats of the fashionable. Years ago, as a boy in Florida, I first had an opportunity of observing the methods employed by the feather hunters in collecting these aigrettes, which are the nuptial plumes of the bird and are to be found on them only in the spring. As a rare treat, I was permitted to accept the invitation extended by a squirrel hunter to accompany him to the nesting haunts of a colony of these birds. Away we went, in the gray dawn of a summer morning, through the pine barrens of southern Florida, until the heavy swamps of Horse Hammock

were reached. I remember following with intense interest the description given by my companion of how these birds with magnificent snowy plumage would come flying in over the dark forest high in air and then volplane to the little pond where, in the heavily massed bushes, their nests were thickly clustered. With vivid distinctness he imitated the cackling notes of the old birds as they settled on their nests and the shrill cries of the little ones as, on unsteady legs, they reached upward for their food.

Keen indeed was the disappointment that awaited me. With great care we approached the spot and with caution worked our way to the very edge of the pond. For many minutes we waited, but no life was visible about the buttonwood bushes which held the nests, — no old birds, like fragments of fleecy clouds, came floating in over the dark canopy of cypress trees. My companion, wise in the ways of hunters, as well as in the habits of birds, suspected something was wrong, and presently found nearby the body of an egret lying on the ground, its back, from which the skin bearing the fatal aigrettes had been torn, raw and bleeding. A little farther along we came to the remains of a second, and then a third and, still farther on, a fourth. As we approached, we were warned of the proximity of each ghastly spectacle by the hideous buzzing of green flies swarming over the lifeless forms of the parent birds.

At one place, beneath a small palmetto bush, we found the body of an egret which the hunters had overlooked. Falling to the ground sorely wounded, it escaped its enemies by crawling to this hiding place. Its attitude spoke plainly of the suffering which it had endured. The ground was bare, where, in its death agonies, it had beaten the earth with its wings. The feathers on the head and neck were raised and the bill was buried among the blood-clotted feathers of its breast. On the higher ground, we discovered some straw and the embers of a camp fire, giving evidence of the recent presence of the plume hunters. Examination of the nests over the pond revealed numerous young, many of which were now past suffering, others, however, were still alive and were faintly calling for food which the dead parents could never bring. Later inquiry developed the fact that the plumes taken from the backs of these parent birds were shipped to one of the large millinery houses in New York, where in due time they were placed on the market as "aigrettes," and of course subsequently purchased and worn by fashionable women, as well as by women of moderate incomes, who sacrifice much for this millinery luxury.

There were, at that time, to be found in Florida many hundreds of colonies of these beautiful birds, but their feathers commanded a large price and offered a most tempting inducement for local hunters to shoot them. Many of the men of the region were very poor and the rich harvest which awaited them was exceedingly inviting. At that time gunners received from seventy-five cents to one dollar and a quarter for the scalp of each bird, which ordinarily contained forty or more plume feathers. These birds were not confined to Florida but, in the breeding season, were to be found in swampy regions of the Atlantic Coast as far north as New Jersey; some were even discovered carrying sticks for their nests on Long Island.

Civilized nations today decry any method of warfare which results in the killing of women and children, but the story of the aigrette trade deals with the slaughter of innocence by the slow process of starvation, a method which history shows has never been followed by even the most savage race of men dealing with their most hated enemies. This war of extermination, which was carried forward unchecked for years, could mean but one thing, namely, the rapid disappearance of the egrets in the United States. As nesting birds, they have disappeared from New Jersey, Maryland, and Virginia, and also from those States of the central Mississippi Valley, where at one time they were to be found in great numbers.

Quite aside from the professional millinery feather hunter there should be mentioned the criminal slaughter of birds by individuals who have killed them for their own lady friends. I know one colony of brown pelicans which was visited by a tourist who killed four hundred of the big, harmless inoffensive creatures in order to get a small strip of skin on either side of the body. He explained to his boatmen, who did the skinning for him, that he was curious to see if these strips of skin with their feathers would not make an interesting coat for his wife. The birds killed were all caring for their young in the nests at the time he and his hirelings shot them.

There was, a few years ago, in a Georgia city, an attorney who accepted the aigrette

scalps of twenty-seven egrets from a client who was unable to pay cash for a small service rendered. He told me he had had much pleasure in distributing these among his lady friends. Another man went about the neighborhood hunting male Baltimore orioles until he had shot twelve; he wanted his sisters to have six each for their Sunday hats. The roseate spoonbill of the Southern States was never extensively killed for the millinery trade and yet today it is rapidly approaching extinction. The feathers begin to fade in a short time and for this reason have little commercial value, but the amateur northern-tourist feather hunter has not known this, or has disregarded the fact, and has been the cause of the depletion of the species in the United States. Almost every one could cite instances similar to the above, for there are many people who are guilty of having had some hand in the destruction of birds for millinery purposes. In addition to the feathers of American birds already mentioned, the feathers of certain foreign species have been very much in demand.

One of the most popular foreign feathers brought to this country is the paradise. About nine species of paradise birds, found in New Guinea and surrounding regions, furnish this product. The males are adorned with long, curved, delicate feathers which are gorgeously colored. As in the case of all other wild birds, there is no way of getting the feathers except by killing the owners. Much of this work is done by natives, who shoot them down with little arrows, blown through long hollow reeds. The high price paid for these feathers has been the occasion of the almost total extinction of some of the species, as indicated by the decreased number of feathers offered at the famous annual London feather sales. Travelers in the regions inhabited by the birds, speak of the distressing effect of the continuous calls of the bereft females, as they fly about in the forests during the mating season. As a high-priced adornment the paradise is the one rival of the famous aigrette.

The marabou which has been fashionable for a number of years past comes principally from the marabou stork of Africa. These white, fluffy, downlike feathers grow on the lower underpart of the body of the marabou stork. These birds are found in the more open parts of the country. Their food consists of such small forms of life as may readily be found in the savannas and marshes. To some extent they also feed like vultures on the remains of larger animals.

The long tail feathers of pheasants have been much in demand by the millinery trade during the past ten years. Although several species contribute to the supply, the majority are from the Chinese pheasant, or a similar hybrid descendant known as the English ring-necked pheasant. Many of these feathers have been collected in Europe, where the birds are extensively reared and shot on great game preserves; vast numbers however, have come from China. Oddly enough, in that country the birds were originally little disturbed by the natives, who seem not to care for meat. Then came the demand for feathers, and the birds have since been killed for this purpose to an appalling extent.

The popular hat decoration called "nubia" suddenly appeared on our market in great numbers a few years ago. It is taken from the Manchurian eared pheasant of northern China. Unless the demand for these feathers is overcome in some way there will undoubtedly come a day in the not distant future when the name of this bird must be added to the lengthening list of species that have been sacrificed to the greed or shortsightedness of man.

The fashionable and expensive hat decoration which passes under the trade name of "goura" consists of slender feathers, usually four or five inches long, with a greatly enlarged tip. They grow out fanlike along a line down the center of the head and nape of certain large ground pigeons that inhabit New Guinea and adjacent islands. Perhaps the best known species is the crowned pigeon.

There is a special trade name for the feathers of almost every kind of bird known in the millinery business; thus, there is "coque" for black cock; "cross aigrettes," for the little plumes of the snowy egret, and "eagle quills" from the wings not only of eagles, but also of bustards, pelicans, albatrosses, bush turkeys and even turkey buzzards. The feathers of macaws are used in great numbers in the feather trade, as well as hundreds of thousands of humming birds, and other bright colored birds of the tropics

Feathers have always been one of the most coveted and easily acquired of feminine adornments. At first they were probably taken, almost wholly, from birds killed for food; but later, when civilization became more complex

and resourceful, millinery dealers searched the ends of the earth to supply the demands of discriminating women. The chief reason why it has been so difficult to induce educated and cultivated women of this age to give up the heartless practice of wearing feathers seems to be the fact that the desire and necessity for adornment, developed through the centuries, has become so strong as to be really an inherent part of their natures. It is doubtful if many people realize how terrifically strong and all-powerful this desire for conforming to fashion in the matter of dress sits enthroned in the hearts of tens of thousands of good women.

There was a time when I thought that any woman with a matured instinct would give up the wearing of feathers at once upon being informed regarding the barbaric cruelties necessarily involved in their taking. But I have learned, to my unutterable amazement, that such is not always the case. Only last week I received one of the shocks of my life. Somewhat over two years ago a young woman came to work in my office. I supposed she had never heard, except casually, of the great scourge of the millinery trade in feathers. Since that time however, she has been in daily touch with all the important efforts made in this country and abroad to legislate the traffic out of existence, to guard from the plume hunters the plundered colonies of egrets and other water birds, and to educate public sentiment to a proper appreciation of the importance of bird protection. She has typewritten a three-hundred-page book on birds and bird protection, has acknowledged the receipt of letters from the wardens telling of desperate rifle battles that they have had with poachers, and written letters to the widow of one of our agents shot to death while guarding a Florida bird rookery. In the heat of campaigns she has worked overtime and on holidays. I have never known a woman who labored more conscientiously or was apparently more interested in the work. Frequently her eyes would open wide and she would express resentment when reports reached the office of the atrocities perpetrated on wild birds by the heartless agents of the feather trade. Recently she married and left us. Last week she called at the office, looking very beautiful and radiant. After a few moments conversation she approached the subject which evidently lay close to her heart. Indicating a cluster of paradise aigrettes kept in the office for exhibition purposes, she looked me straight in the face and, in the most frank and guileless manner, asked me to sell them to her for her new hat! The rest of the day I was of little service to the world.

What was the good of all the long years of unceasing effort to induce women to stop wearing bird feathers, if this was a fair example of results? Of all the women I knew, there was no one who had been in a position to learn more of the facts regarding bird slaughter than this one; yet it seems that it had never entered her mind to make a personal application of the lesson she had learned. The education and restraint of legislative enactments were all meant for other people.

How is this deep-seated desire and demand for feathers to be met? Domestic fowls will in part supply it; but for the finer ornaments we must turn to the ostrich, the only bird in the world which has been domesticated exclusively for its feather product. These birds were formerly found wild in Arabia, southwestern Persia, and practically the whole of Africa. In diminishing numbers they are still to be met with in these regions, especially in the unsettled parts of Africa north of the Orange River. From early times the plumes of these avian giants have been in demand for head decorations, and for centuries the people of Asia and Africa killed the birds for this purpose. They were captured chiefly by means of pitfalls, for a long-legged bird, which in full flight can cover twenty-five feet at a stride, is not easily overtaken, even with the Arabs' finest steeds.

So far as there is any record, young ostriches were first captured and enclosed with a view of rearing them for profit in the year 1857. This occurred in South Africa. During the years which have since elapsed, the raising of ostriches and the exportation of their plumes has become one of the chief business enterprises of South Africa. Very naturally people in other parts of the world wished to engage in a similar enterprise when they saw with what success the undertaking was crowned in the home country of the ostrich. A few hundred fine breeding birds and a considerable number of eggs were purchased by adventurous spirits and exported, with the result that ostrich farms soon sprang up in widely separated localities over the earth. The lawmakers of Cape Colony looked askance at these incipient

competitors and soon prohibited ostrich exportation. Before these drastic measures were taken however, a sufficient number of birds had been removed to other countries to assure the future growth of the industry in various regions of the world. It was in 1882 that these birds were first brought to the United States for breeding purposes. Today there are ostrich farms at Los Angeles, San Diego and San José, California; Hot Springs, Arkansas; Jacksonville, Florida, and a few others elsewhere.

There is money to be made in the ostrich business, for the wing and tail plumes of this bird are as popular today for human adornment as they ever were. Even low grade feathers command a good price for use in the manufacture of boas, feather bands, trimming for doll hats and other secondary purposes. When the time comes for plucking the feathers, the ostriches are driven one at a time into a V-shaped corral just large enough to admit the bird's body and the workman. Here a long slender hood is slipped over his head and the wildest bird instantly becomes docile. Evidently he regards himself as effectively hidden and secure from all the terrors of earth. There is no pain whatever attached to the taking of ostrich feathers, for they are merely clipped from the bird by means of scissors. A month or two later, when the stubs of the quills have become dry, they are readily picked from the wings without injury to the new feathers.

The ostrich industry is worthy of encouragement. No woman need fear that she is aiding the destruction of birds in any way by wearing ostrich plumes. There are many more of the birds in the world today than there were when their domestication first began, and probably no wild African or Asiatic ostriches are now shot or trapped for their plumes. The product seen in our stores all comes from strong happy birds hatched and reared in captivity. Use of their feathers does not entail the sacrifice of life, nor does it cause the slightest suffering to the ostrich; taking plumes from an ostrich is no more painful to the bird than shearing is to a sheep, and does not cause it half the alarm a sheep often exhibits at shearing time.

If the call for feather finery rings so loudly in the hearts of women, that it must never cease to be heard, it is the ostrich — the big, ungainly, yet graceful ostrich — which will supply the high grade feathers of the future.

Courtesy of National Association of Audubon Societies

A sickening slaughter of snowy herons (egrets) to satisfy the demands of fashion and the vanity of woman

Stories of South American Birds

PERSONAL EXPERIENCES WITH ESPECIAL REFERENCE TO THE NESTING HABITS OF FLYCATCHERS, SPINETAILS, JACAMARS, ORIOLES, AND PUFF BIRDS

By GEORGE K. CHERRIE

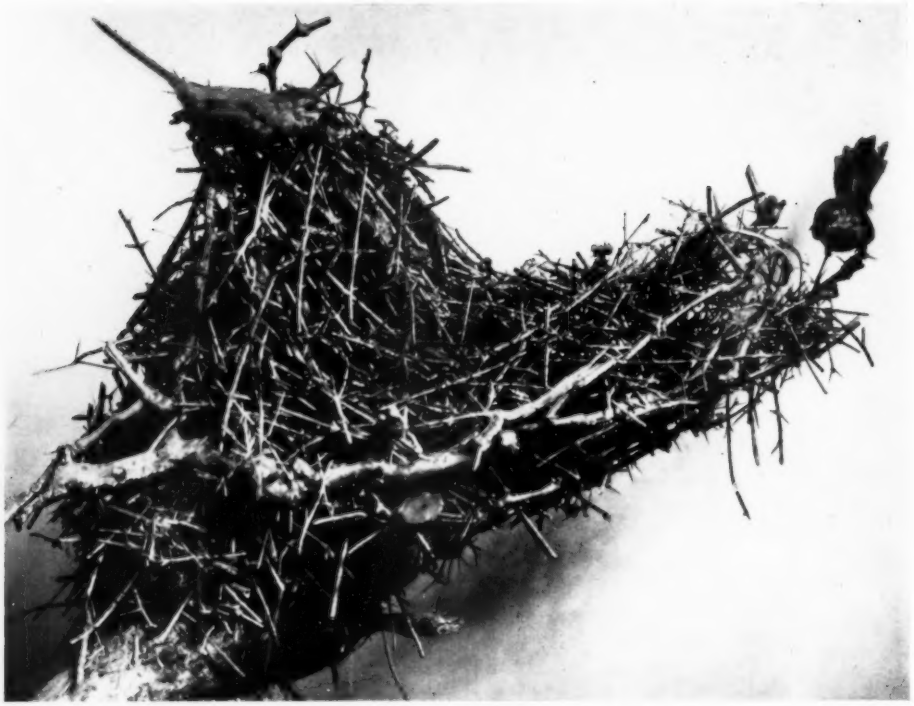
IN my long experience as a natural history collector, particularly in South America, I have derived the greatest pleasure from studying the nesting habits of the birds. In addition to the pleasure obtained, a careful study of nests, eggs, and habits of the adult birds at nesting time has enabled me to learn much regarding relationships of various species. There is much also to be learned about bird psychology as a result of such study.

Apropos of the latter, I have frequently been asked if I thought individual birds showed peculiar tastes, in any way differing from other birds of the same species, and in reply I have sometimes told of my experience with the broad-billed yellow flycatcher of the genus *Rhynchocyclus*, which is very abundant along the middle Orinoco. Near my camp, in the neighborhood of Caicara, I found many nests of these birds; in one case three of them within a radius of fifty yards. One of these three was composed entirely of small, thread-like vegetable fibers of a shiny black color. Another was of dark gray-brown fibers, while the third was composed of very fine grasses, pale brownish-gray in color. There is little doubt that the black vegetable fibers were just as abundant and as easily accessible to the two other pairs, as to the birds that employed them in the construction of their nest; so also were the gray fibers as accessible to the birds using the black ones. If it was not individual taste that induced the birds to employ the different colored fibers, I do not know what it was.

As showing how light can be thrown on the relationships of birds the following instance is of interest. Of the nests of six species of spinetail (*Synallaxis*) that I have found, five were of the usual form and materials; extraordinary structures about three-fourths of a yard long, composed of dry, usually thorny twigs, skillfully woven into a cylindrical mass, with a long tubular entrance to the nest cavity, which occupies the lower half of the cylindrical nest body. This nest might be described as retort shaped. It is sometimes built within a few inches of the ground, but may be several yards above it. The nest proper is supported ordinarily between the twigs or small branches of the limb, while the entrance to the nest lies along the main branch and is held up by it. As a rule, these thorny nests are not concealed in any way by surrounding foliage or bushes, the birds apparently depending upon the sharp thorns of which the nest is composed for protection; also, the nest proper is concealed by the great mass of twigs on the top of it. These twigs are laid longitudinally, so as to form a kind of thatched roof, thus protecting the nest from rain — as it is usually occupied during the height of the rainy season.

The nest cavity is lined with soft dry leaves and wood fiber, as a foundation for an inner nest lining of gray lichens. The nests of five of the species of spinetail were all of this general type, but that of the sixth species, the fox-red spinetail, was entirely different. I had been seeking the nest of this species for weeks, and some time prior to my discovery of it I found a pair of the birds hovering about what appeared to me to be a mass of drift grass, that had lodged between the forks at the top of a slender sapling. At that time it was about two meters above the surface of the river. (The sapling stood in a flooded area perhaps one hundred meters from the river shore.)

Masses of drift grass, like that on which the spinetails were at work, are very common along the river after the season of high water, and in many cases represent merely accumulations of drift. On the other hand, in many cases they have as their foundation old nests of *Pitangus* or *Myiozetetes*, or other birds that construct nests of grass toward the tips of the limbs in trees growing in these seasonally submerged areas. These nests become impregnated with a fine sediment from the surrounding water, and as the water recedes,



The nest of the white-throated spinetail is characteristic of spinetail nests in general, composed of sharp thorns and twigs and entered by a tubular passage. The nest is placed in a low thorn bush, and if it is touched or shaken the young of this species, when nearly fledged, have the singular habit of running out, jumping to the ground, and concealing themselves in the long grass

the mud-filled nests, or masses of drift as the case may be, become tenanted by many forms of insect life, soon developing into favorite hunting grounds for various species of insect-feeding birds. These gradually tear them to pieces and often pierce them through and through with tunnels in search of their insect prey.

It was such a ragged piece of drift that this particular pair of spinetails had laid claim to. When discovered, the interior was pierced by several tunnels. One of these had been closed at one end with leaves and vegetable fibers, and a large nest cavity had been excavated at about its middle. Some dry leaves and wood fiber were there as a nest lining and, as an inner nest lining, the same kind of gray lichens as in the nests of the other five species of spinetail. Outwardly, the nest was a mere bunch of drift grass: the site chosen and the materials employed were wholly different from those used by the allied species. In the use of the gray lichens for an inner nest lining however, we find a trait common to all.

The question naturally arises, "Is the use of this gray lichen for the inner lining of the nest cavity a custom descended from distant common ancestors?"

There is perhaps no group of birds in all the tropics that will more richly repay careful study of its nesting habits, than the flycatchers. There is certainly no group in which occurs a greater variety of nests. Some species for instance build tiny, frail, lichen-covered nests, as dainty as any of those built by the humming birds. Some weave structures that might well serve as a model for the African weaver birds. Certain flycatchers, on the other hand, build bulky rough nests that remind one of the work of jays or crows. Some members of the group are secretive, constructing their nests in the most sheltered and retired spots in the thick forest, hidden among bunches of leaves, or otherwise concealed. A few nest near the ground; others place their nests high up in the tree tops, while in the open plains districts of the great river basins, there are perhaps few objects more prominent in the landscape than the

great grass nests of the yellow-breasted flycatchers in the tops of the low trees.

One of the most interesting South American nests I have found is that of the two-banded *Bucco* or puff bird. This species has the extraordinary habit of excavating into occupied nests of the common termite, or white ant, of the region (whose nests are so conspicuous in many of the forest trees). The *Bucco* usually makes the entrance to its nest in the middle of the side of the termite nest, the tunnel passing backward and upward for nearly the entire diameter of the termite dwelling, and ending in a slightly enlarged spherical chamber about fifteen centimeters in diameter — the entrance tunnel being only about one-half that width. No nesting material is carried in, the eggs being deposited on the débris at the bottom of the nest cavity. It has always been a mystery to me how the birds were able to carry on their work of excavation, because termites, at the slightest disturbance, swarm out in countless thousands, and I cannot conceive how any living object could endure being covered by these viciously biting little insects. Another problem I have not been able to solve is how the young birds, particularly immediately after being hatched, could possibly survive.

No less curious are the bed-fellows some of the jacamars have in their nests. Somewhat kingfisher-like in form, but decidedly more like humming birds in plumage, the jacamars construct their nests after the manner of the kingfishers, that is by excavating a hole in the bank of a stream, or in an embankment of any sort, carrying their tunnel back for a distance of about a yard from its entrance, and usually slanting it slightly upward so that water is prevented from running down into the cavity and accumulating there. No soft lining is taken into these nests, but great quantities of beetles and other insects are deposited around the eggs after they have been laid, or the eggs are deposited on the insect mass after it has been taken in. After the insect mass has remained for some time in the nest cavity, flies are attracted by the decaying bodies. As a result maggots develop, and I have found the eggs resting on a squirming, writhing mass of maggots! There are many natural history problems here presented. Does the parent jacamar incubate the eggs sitting on the top of this mass of maggots, or is the heat from this writhing mass sufficient to induce incubation? If the

Nest of broad-billed yellow flycatcher. Brown, black, and gray nests of this species were found, seeming to indicate exercise of individual taste by their builders.— Nest of fox-red spinetail in a mass of drift grass; unlike nests of other spinetail species

young birds should emerge from the egg into the mass of maggots, there is no doubt in my mind that they would very quickly die. Does the jacamar so time the depositing of its eggs that the young will not emerge until after the maggots have gone into the pupa stage?

Other species of birds, such as the motmots, carry quantities of insects into their nests, but only after the young are born. I have frequently found very vile-smelling nests of these birds, but no maggots develop until after the young are pretty well grown, and indeed have moved from the nest cavity proper, so that they escape immediate contact with the maggots.

A species of puff bird whose nest I had long sought was discovered finally quite by accident. One day, as I was trying to protect myself from a sudden shower that had overtaken me in the forest, and was crowding in among the thick branches of a low tree, I heard a sound that seemed to come from the ground beside me — the cheep of a young bird. I looked about on all sides but could not discover anything. The sound was repeated. It seemed nearer to my feet than before but nothing was in sight. My attention however was presently fixed on what appeared to be a small pile of brush that had been brought together by a current of wind. Closer examination revealed the fact that there was an entrance beneath this pile of brush on one side, where the ground seemed to have been swept clean by some animal entering and leaving. With a movement of my foot I pushed the brush aside, and was surprised to find beneath it a good-sized hole leading down into the ground. I had no idea what the occupant might be, but secured a long stick with a fork on the end of it. I punched this into the hole to discover whether there was a tenant, and was surprised to hear a bird's sharp squeak as a result of my investigation. A few twists of the stick in my hand and I drew it out with a bird attached to the end, the feathers having become entangled about the small fork. It

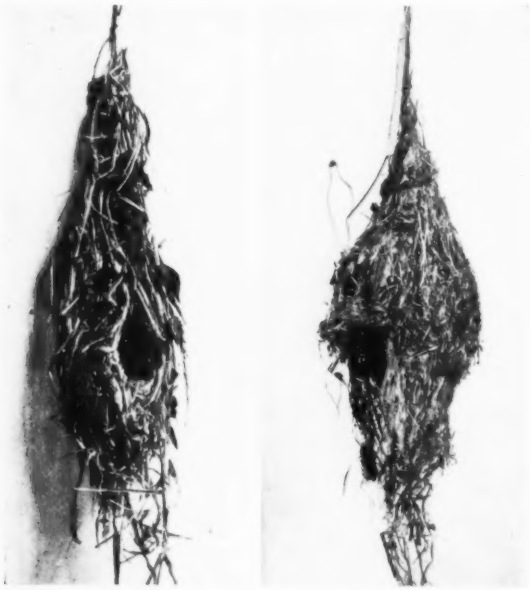
An oriole nest suspended beneath the midrib of a banana leaf and between the webs of the two halves, which are pierced and slit to permit the interweaving of the supporting fibers. In the fresh green leaf the incisions are not evident at any distance, so that the nest itself is concealed both from above and from the sides, and is protected from sun and storm as well as from enemies

COLONY OF THE WHITE-BILLED HANGNESTS

These bird villages — from six to seventy-five or eighty nests — are always built near the nest of some species of wasp or bee (see right of picture) probably for the protection afforded by the pugnacious insects. Cordial good fellowship appears to exist between the birds and insects, and should the wasp nest be destroyed or abandoned the bird colony dwindles and disappears. The colonies are sometimes so compact that three or four nests may press against one another or actually be woven together. These birds are common along the Orinoco and other river beds, and the nests are made from long, tough, narrow-bladed marsh grasses

was a surprise to find a bird at all, but it was a greater surprise to find the bird a puff bird.

Whether this nest cavity, which was about five feet in depth, had been excavated by the puff birds I do not know, as this is the only nest I have ever found of the species, but if the puff bird did construct its own nest cavity, the earth that was removed was carried some distance away leaving no sign of it about the entrance. This however, is perhaps not surprising, for the swallow-wing, another relative of the puff birds, is known to excavate its own nest cavity, digging down sometimes for a couple of feet in the open level prairies, and while doubtless a large amount of dirt and sand are carried out, no accumulation of such material is ever found about the entrance. There is no doubt that the pile of brush over the entrance to the red-billed puff bird's nest had been placed there by the birds themselves. It was a fine example of how birds sometimes build structures, either to hide their nests or to protect themselves.



Nests of two species of the flat-billed flycatcher. Like the hangnests, these birds seek the protection of insect neighbors, often suspending their nests from the tips of the branches of trees infested with stinging or biting ants

The orioles and hangnests have some very interesting and curious nesting habits. For instance there is one form of white-billed hangnest that, I believe, always constructs its nest (or nests, as this species builds in colonies) in the immediate neighborhood of, or surrounding, the nest of some species of wasp. Year after year these colonies increase in size as the wasp nest increases in size, and if through any accident the wasp nest is destroyed or abandoned, within a year or two that locality will be abandoned by the hangnests also. I remember a case in which a colony of these birds nested in one place for ten consecutive years. At the end of that time I cut the branch that supported the wasp nest, thus destroying the wasp colony. Three years later, when I visited the locality, there were not more than six pairs of birds in the colony that had previously been tenanted by at least one hundred birds.

The orioles and hangnests are not the only species of birds that seem to derive protection, or company, from neighborliness with the wasps. Very often I have found nests of tanagers, and also some of the smaller fly-catchers, near those of the wasp. Apparently there is never any misunderstanding between the respective tenants of the different colonies, but there is little doubt that should a monkey, for instance, attempt to get into a nest of the colony of hangnests, it would be very quickly driven away by the insects.

An instance of a similar protection occurs among the small flat-billed fly-catchers of the genus *Todirostrum*, which frequently suspend their nests at the ends of twigs or branches inhabited by some of the vicious species of stinging or biting ants. These no doubt furnish protection from any of the bird's enemies that might attempt to creep down the branches, and I have frequently had my hands severely stung by the small irate tenants of such branches.

Museum Notes

SINCE the last issue of the JOURNAL the following persons have become members of the Museum:

Life Members, MISS JULIA J. PIERREPONT and MESSRS. GATES W. MCGARRAH and RUSSELL PERKINS;

Sustaining Members, MESSRS. MAX HERMAN and HOWARD NOTMAN;

Annual Members, MRS. H. S. BOWEN, MRS. GARDINER GAYLEY, MRS. PAUL GOTTHEIL, MRS. CHARLES W. LEAVITT, MRS. BANYER LUDLOW, MRS. E. L. LUDLOW, MRS. JOHN H. LYNCH, MRS. JAMES W. MCLANE, MRS. EMERSON MACMILLIN, MRS. GEORGE MASSEY, MRS. PONSONBY OGLE, MRS. CHARLES ALBERT PERKINS, MRS. WILLIAM C. PEYTON, MRS. G. M. PHELPS, MRS. ERNEST POOLE, MRS. HOWARD L. THOMAS, MRS. CATHERINE D. VERNON, MISSES LULU BENZIGER, SARAH J. DAY, M. E. KOHLER, MARY L. LUDINGTON, ETHEL L. MCLEAN, LILY S. PIQUET, and H. WHITE, DR. A. A. BRILL, DR. WALTON MARTIN, DR. HARRY H. WEIST, and MESSRS. C. W. ELMER, JAMES C. FARRELL, HENRY HEIDE, JR., WILLIAM W. KELCHNER, W. G. KEUFFEL, G. LEVOR, C. R. MILLER, AUGUSTUS L. MOSS, BENJAMIN NICOLL, MURRAY OLYPHANT, EDGAR PALMER, WILLIAM C. PAYTON, JOHN O. H. PITNEY, WILLIAM L. RANSOM, HENRY SCHREITER, BLEECKER VAN WAGENEN, and WILLIAM P. WAINWRIGHT.

THE American Museum of Natural History announces the establishment of a new class of membership in the institution. For some time it has been evident that there is a very large number of people who would enjoy being associated with the American Museum, yet who, because of remote residence from New York City and infrequent visits, cannot participate in the lectures and various other privileges that come to the Annual Member from his near residence. To enable these friends to become identified with the work of the institution the trustees have just created a new class of membership to be designated as "Associate Members." The only condition of eligibility to Associate Membership is that the candidate reside at least fifty miles from New York City and pay the annual membership fee of three dollars. Associate Members receive current issues of the American Museum Journal, a complimentary copy of the President's Annual Report, an annual pass admitting to the Members' Room, two complimentary tickets admitting to the Members' Room for distribution by Members to their friends, and the services of an instructor for guidance when visiting the Museum. Already more than one hundred Associate Members have been enrolled from twenty-two different states, as far apart as Vermont, California, Louisiana, and Winnipeg. It is hoped that present members will coöperate with the Museum in making this opportunity known to those whom it may interest.

MR. J. P. MORGAN has financed in part the excavation by the American Museum of Natural History, of the famous Aztec ruins in the northwest corner of New Mexico. The name "Aztec" has no historical significance in this case but is a part of the folklore of the Southwest, presumably because the first explorers, who were familiar with the Aztec culture of Mexico, assumed that all of the ruins and evidences of higher culture in America were to be attributed to the Aztecs. The ruins are in fact of the well-known Pueblo type, and belong distinctly to prehistoric Pueblo peoples, since these ruins have never been occupied since the discovery of the country by the Spaniards. Notwithstanding their great age the ruins are in an excellent state of preservation and constitute a very rich archæological site. Many of the walls are standing to the second story and portions of the timbered ceilings still exist, some of the cedar beams being still in place. The owner of the ruins, Mr. H. D. Abrams, has very carefully protected them from vandalism for many years, so that they are on the whole the best-preserved ruins in the Southwest. An arrangement has been made with Mr. Abrams by which the ruins are to be scientifically studied and excavated by the Museum. Five seasons will be required for this work. Besides the large ruin, there are five or six smaller ones, and the old reservoir even is preserved. Mr. N. C. Nelson will set out for New Mexico on May 4 to make preliminary surveys, and will be joined there by Mr. Earl H. Morris of the University of Colorado who will assist in the excavations. Mr. Nelson will also undertake the excavation of pueblo ruins near Zuñi, with the assistance of Mr. Leslie Spier.

HEALTH ON THE FARM

A farm where typhoid and malaria will quickly spread, contrasted with the same farm cleaned up and made sanitary. The health of the city dweller is guarded by an elaborate organization of experts whose function it is to secure for him pure water and milk and food and protection against communicable disease in various forms. In the country however each householder must be to a considerable extent his own sanitary engineer and his own board of health

These models with detailed descriptions are to be found in the hall of public health of the American Museum

It is with extreme gratification that the library of the American Museum of Natural History announces its recent acquisition of a very handsome two-volume copy of the first edition in Latin of the "Peregrinationes," by Theodorus De Bry, 1590–1602, the generous gift of Mr. Ogden Mills.

Sometime in or before 1587, Theodorus De Bry, a German engraver and publisher of Frankfort-on-Main, visited London, and there became acquainted with the geographer, Richard Hakluyt. With Hakluyt's assistance, De Bry collected materials for a finely illustrated collection of voyages and travels. The publisher intended, originally, that the "Collectiones Peregrinationum in Indiam Orientalem et Indiam Occidentalem" should appear in English, French, German and Latin. So stupendous, however, proved to be the undertaking, that all thoughts of a French and English edition had to be dropped after the publication of the first volume in 1590. In 1598 Theodorus De Bry died, and the work was continued by his widow, and his sons, Johann Theodor (1561–1623), and Johannes Israel (-1611). The "Peregrinationes" were finally completed in 1634, forty-four years having been required for their publication. To the Museum library, however, and to its users, bibliographic importance is never of paramount interest. Books are valued for their contents and authority, and, pragmatically, for their degree of usefulness, and such beguiling fields as book collecting *per se* must, naturally, be consistently avoided. The "Peregrinationes," however, combine to a most unusual extent both bibliographic and intrinsic importance. If De Bry is rare, he is also exceedingly valuable for research into the anthropology and early zoölogical knowledge of the New World.

Mr. Mill's interest in rare books, and his liberality toward the library of the American Museum have already been remarkably instanced by his gift last November of the nine volume set of Lord Kingsborough's "Mexican Antiquities," and more recently of the original manuscript of "The Butterflies of North America; Whence they come; where they go; and what they do," by Titian Ramsey Peale.

Dr. Frank M. Chapman, accompanied by Mr. George K. Cherrie, will leave New York on May 6, for a general ornithological survey of the South American regions from which the Museum has been acquiring collections during the past five years. Dr. Chapman will proceed first to Ecuador, to obtain, from the upper slopes of Mount Chimborazo, material for a group representing birds of the paramo. This is to be a companion to another proposed group, showing the bird life of tropical South America in the valley of the Magdalena in Colombia, for which studies have already been made. Going next to Cuzco, in Peru, Dr. Chapman intends to study the distribution of bird life in the Urubamba Valley. This latter work is to be done under the joint auspices of the American Museum of Natural History and the Yale Peruvian National Geographic Expedition. Dr. Chapman hopes later to meet Mr. Leo E. Miller in Argentina, and to gather there material for a pampas habitat group. One of the objects of the expedition is to establish general relations with the large museums of Chile, Argentina, and Brazil, and to this end Santiago, Buenos Aires, Sao Paulo, and Rio de Janeiro will probably be visited. Dr. Chapman expects to return in October, but Mr. Cherrie will remain in South America to take up zoölogical work for the Roosevelt Expedition in the marshes of Paraguay.

Miss M. C. Dickerson has recently returned from a brief stay in Florida, where she has been making studies and collecting accessories for the large habitat group representing the reptile and batrachian life of that region. The group is now in process of construction in the Museum's taxidermy studio, under Miss Dickerson's supervision; it is the fifth in the series of groups showing the home life of reptiles, and the largest yet attempted [The cover designs of this issue of the Journal show two of the photographic studies made.]

The photograph (reproduced on page 216) of the Brooklyn Museum's coral reef group, gives only an inadequate impression of its complexity and beauty. It represents an actual reef at Sandy Cay, in the Bahamas. Among the branches of the staghorn coral, in the upper left hand corner of the group, appears a school of young red snapper fish; below are gayly colored gorgonians and sea fans, and a colony of the tube sponge. On the white sand in the foreground is a brown sea star, and beside it a stinging sea urchin with black, needlelike spines. At the right

is a fine specimen of greenish-yellow brain coral, above which swims the black and yellow fish, rock beauty (*Holacanthus tricolor*). The coral-red base and fringe-crowned disk of the passion flower anemone (*Condylactis passiflora*) appear on different portions of the reef. Wax models of the more delicate animals and color studies of all the group material, were made in the field, and the effect of real sea water, with its depth and perspective, has been obtained by using two panes of plate glass, three inches apart, in front of the group, each coated on the inner side with a delicate invisible stain of gelatin.

Sir Douglas Mawson, on his way through New York recently, reported that he had made a renewed attempt to secure for the American Museum a full series of the skins of the Antarctic penguins from Macquarie Island. The few skins however, brought back by the party sent there in 1915, were useless because so poorly prepared. Sir Douglas Mawson is making efforts to establish Macquarie Island as a national reserve for wild life and thinks that the Commonwealth of Australia is likely to take favorable action. There has been great difficulty in relieving the small colony on the island, and at Christmas the government station there was abandoned, but may be resumed after the close of the war.

A meeting of those members of the American Association for the Advancement of Science who live in or near New York was held in the American Museum of Natural History on the afternoon of May 5, to arrange for the annual meeting of the Association, which is to take place this year in New York City on December 26–31, inclusive. President Henry Fairfield Osborn, of the American Museum, presided at the conference, and a motion was adopted to make Columbia University the official headquarters of the meeting, which is expected to be the largest and most important gathering of scientists ever before convened. About two thousand delegates are expected, and a reception committee is to be appointed consisting of prominent citizens of New York interested in scientific work.

On Friday evening, May 26, in the auditorium of the Museum, Mr. Charles Crawford Gorst, of Cambridge, Mass., will give a special entertainment for the adult blind of New York City and vicinity. The program will consist of two whistling solos, Mendelssohn's "Spring Song," and the waltz from Gounod's "Faust," as well as some unusual feats of whistling, and the imitation of about sixty common bird songs. Mr. Gorst imitates such complicated songs as those of the wood thrush, bobolink, and mocking bird with much exactness. His work along this line is approved by naturalists and ornithologists, by whom he is generally regarded as the best imitator of the wild bird songs of our country. In his lecture Mr. Gorst will touch upon bird songs compared with human music, descriptive quality of bird music, and the language of birds. The lecture will begin at 8:15, but the memorial hall will be open at 7:30 to give the blind an opportunity of handling specimens of the birds whose songs are to be imitated. This lecture is the last for the adult blind given at the Museum this season.

Mr. George Shosbree, taxidermist of the Public Museum of Milwaukee, is spending a month at the American Museum, studying the new processes in taxidermy under Mr. Carl E. Akeley.

Mr. Walter Winans, of Surrenden Park, England, has presented to the American Museum the skin and skull of a Chillingham wild bull, a specimen of the famous white cattle, long supposed to be descended from the wild stock that once inhabited Britain. After much discussion of the subject it now seems evident that the Chillingham cattle are not descended from indigenous wild ancestors, but from white cattle originally introduced into the island by the Romans for sacrificial purposes.

According to cablegrams received from the Crocker Land Expedition, and from Dr. E. O. Hovey of the relief expedition, both parties are safe and well. Arrangements are being considered for their transport to New York either by Mr. Rasmussen's ship "Kap York," or by a special relief ship to be sent out by the American Museum.

An exhibit showing the principal birds mentioned in Shakespeare's plays has been installed in the west corridor as the Museum's contribution to the Shakespeare Tercentenary Celebration. Each specimen is accompanied by a quotation in which the bird is mentioned. The exhibit has been prepared by Mr. Charles H. Rogers.

The American Museum of Natural History

Seventy-seventh Street and Central Park West, New York City

Open free to the public on every day in the year.

The American Museum of Natural History was established in 1869 to promote the Natural Sciences and to diffuse a general knowledge of them among the people. It is dependent upon private subscriptions and the fees from members for procuring needed additions to the collections and for carrying on explorations in America and other parts of the world. The membership fees are,

Annual Members	$ 10	Patrons	$1,000
Sustaining Members (annually)	25	Associate Benefactors	10,000
Life Members	100	Associate Founders	25,000
Fellows	500	Benefactors	50,000

Guides for Study of Exhibits are provided on request to members and teachers by the department of public education. Teachers wishing to bring classes should write or telephone the department for an appointment, specifying the collection to be studied. Lectures to classes may also be arranged for. In all cases the best results are obtained with small groups of children.

The Museum Library contains more than 60,000 volumes with a good working collection of publications issued by scientific institutions and societies in this country and abroad. The library is open to the public for reference daily — Sundays and holidays excepted — from 9 A. M. to 5 P. M.

The Technical Publications of the Museum comprise the *Memoirs*, *Bulletin* and *Anthropological Papers*, the *Memoirs* and *Bulletin* edited by J. A. Allen, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

The Popular Publications of the Museum comprise the JOURNAL, edited by Mary Cynthia Dickerson, the *Handbooks*, *Leaflets* and *General Guide*. The following list gives some of the popular publications; complete lists, of both technical and popular publications, may be obtained from the Librarian.

POPULAR PUBLICATIONS

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS. By Clark Wissler, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

INDIANS OF THE SOUTHWEST. By Pliny Earle Goddard, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

ANIMALS OF THE PAST. By Frederic A. Lucas, Sc.D. *Paper, 35 cents.*

DINOSAURS. By W. D. Matthew, Ph.D. *Price, 25 cents.*

ILLUSTRATED GUIDE LEAFLETS

GENERAL GUIDE TO THE COLLECTIONS. New edition issued December, 1914. *Price, 25 cents.*

THE COLLECTION OF MINERALS. By Louis P. Gratacap, A.M. *Price, 5 cents.*

NORTH AMERICAN RUMINANTS. By J. A. Allen, Ph.D. *Price, 10 cents.*

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH. By George H. Pepper. *Price, 10 cents.*

PRIMITIVE ART. *Price, 15 cents.*

THE BIRDS OF THE VICINITY OF NEW YORK CITY. By Frank M. Chapman, Sc.D. *Price, 15 cents.*

PERUVIAN MUMMIES. By Charles W. Mead. *Price, 10 cents.*

THE METEORITES IN THE FOYER OF THE AMERICAN MUSEUM OF NATURAL HISTORY. By Edmund Otis Hovey, Ph.D. *Price, 10 cents.*

THE HABITAT GROUPS OF NORTH AMERICAN BIRDS. By Frank M. Chapman, Sc.D. *New edition in course of preparation.*

THE INDIANS OF MANHATTAN ISLAND AND VICINITY. By Alanson Skinner. *Price, 20 cents.*

TREES AND FORESTRY. By Mary Cynthia Dickerson, B.S. *A new edition in course of preparation.*

THE PROTECTION OF RIVER AND HARBOR WATERS FROM MUNICIPAL WASTES. By Charles-Edward Amory Winslow, M.S. *Price, 10 cents.*

PLANT FORMS IN WAX. By E. C. B. Fassett. *Price, 10 cents.*

THE EVOLUTION OF THE HORSE. By W. D. Matthew, Ph.D. *Price, 20 cents.*

MAMMOTHS AND MASTODONS. By W.D.Matthew, Ph.D. *Price, 10 cents.*

HOW TO COLLECT AND PRESERVE INSECTS. By Frank E Lutz, Ph.D. *Price, 10 cents.*

OUR COMMON BUTTERFLIES. By Frank E. Lutz, Ph.D., and F. E. Watson. *Price, 15 cents.*

THE BIG TREE AND ITS STORY. *Price, 10 cents.*

REPRINTS

THE GROUND SLOTH GROUP. By W. D. Matthew, Ph.D. *Price, 5 cents.*

THE WHARF PILE GROUP. By Roy W. Miner, A.B. *Price, 5 cents.*

THE SEA WORM GROUP. By Roy W. Miner, A.B. *Price, 10 cents.*

THE ANCESTRY OF THE EDENTATES. By W. D. Matthew, Ph.D. *Price, 5 cents.*

HEREDITY AND SEX. By Frank E. Lutz, Ph.D. *Price, 10 cents.*

At the edge of a cypress swamp.—This and the front cover are from photographic studies recently made in Florida by Miss M. C. Dickerson, preliminary to the construction of a Florida group in the American Museum of Natural History